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Designing Pension Programs to Strengthen Formal Labor Markets in Developing Countries: The Case of Indonesia

by

Muliadi Widjaja

A Dissertation Submitted in Partial Fufillment

of the Requirements for the Degree

of

Doctor of Philosophy

in the

Andrew Young School of Policy Studies

of

Georgia State University

GEORGIA STATE UNIVERSITY

2007

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ACCEPTANCE

This dissertation was prepared under the direction of the candidate's Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Economics in the Andrew Young School of Policy Studies of Georgia State University.

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ABSTRACT

Designing Pension Programs to Strengthen Formal Labor Markets in Developing Countries: The Case of Indonesia

By

Muliadi Widjaja

Date

December 2007

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Despite many studies of the pension systems in developed countries, little work has been done on how to apply a sustainable pension system in developing countries. The set-ups of pension systems in developed versus developing countries are expected to be different because in developing countries much labor is concentrated in informal production sectors, while labor in developed countries is more fully located in formal production sectors. Informal production sectors are sectors where the government has few tools to implement fiscal policies (taxes and subsidies) on firms and labor. This research develops a comprehensive system on how to set up pension policies generally in developing countries and specifically in Indonesia.

The basic set-up of the pension system suggested in this dissertation is multidimensional: a short run consumption tax policy to finance a defined benefit plan to support minimum physical needs of the older population, a medium run labor income tax

policy to finance individuals defined contribution fully funded savings plan, and a long run skilled labor creation through university education so that individuals are able to self-finance their own pension savings through the fully funded savings plan. The defined benefit plan is important because it serves as a societal redistribution tool, while the defined contribution plan serves as a household savings tool. In addition, the skilled labor creation serves as a supporting tool so that the pension program can be sustained in the long run.

A theoretical model is developed from Auerbach and Kotlikoff that utilizes an overlapping generation (OLG) computable general equilibrium (CGE) model, calibrated for the Indonesian economy by introducing heterogeneity in households including skilled and unskilled labor. I apply a mathematical programming system for general equilibrium analysis (MPSGE), developed by Thomas Rutherford. Some parameters used in the model are estimated by using econometric methods. The OLG-CGE model is applied in order to analyze the impact of consumption taxes and pension taxes on labor supply and also to calculate the equivalent variation of the distribution of consumption tax burden across generations. Meanwhile, the impact of skilled labor creation on economic growth is calculated by applying linear algebra. The main macroeconomic data are taken from the Indonesian social accounting matrix (SAM) for the year 2000. Labor data are taken from the Indonesian labor condition 1998-2003.

My main findings in this dissertation are several. For the equivalent variations, the consumption taxes for USD 1, USD 2, and USD 3 cash transfers per day per person give more benefit to skilled labor than to unskilled labor. The consumption taxes for USD 1 cash transfer give incentives to the largest amount of labor, both skilled and

unskilled labor, to work in the formal sector. The amount of labor after the consumption taxes for USD 1 cash transfer is higher than the initial condition. Increasing the consumption taxes for the USD 2 cash transfer decreases the amount of labor in the formal sector, with the amount of skilled labor decreasing more than unskilled labor. In addition, increasing the consumption taxes for the USD 3 cash transfer would also decrease the amount of labor in the formal sector, with the amount of unskilled labor decreasing more than skilled labor. I also find that the elasticity of government education expenditures with respect to skilled labor creation is roughly 0.3. This means that, if the Indonesian central government would like to eliminate the informal sector by 25 percent within 20 years or an average 1.25 percent annually, they must increase government education expenditures to 8 percent of total annual government budget. Finally, I show that the increase of skilled labor would contribute positively to the Indonesian economic growth, while the consumption taxes and the fully funded pension taxes would likely reduce the current economic growth but increase the future one.

My theoretical contributions are several. First, given dual formal and informal labor sectors present in an economy, where the latter is dominant, taxation of expenditures is preferred to taxation of income because the first may induce labor to work in the formal sector. Second, given dual formal and informal labor sectors present in an economy, where the latter is again dominant, there exists an optimal level of consumption taxes that provides incentives for the highest amount of labor, skilled and unskilled labor, to work in the formal sector.

CHAPTER ONE

Introduction

Demographic changes take place in every country all over the world. In many countries, parents tend to have fewer children than those in previous generations, and, because of good health facilities, older people tend to live longer than those in previous generations (Gruber and Wise, 2001; Weil, 2006). This situation has led to a decreasing ratio of working population to elderly population. Such phenomenon is called an "aging population", and is featured in Table 1.

Table 1. The Ratio of Work Force to Elderly (age 15-59 to age 60+) in Select Countries

Countries	Year		
	2000	**2025**	**2050**
Canada	3.8	2.0	1.7
China	6.4	3.2	1.8
French	3.0	1.9	1.6
Germany	2.6	1.6	1.3
India	7.8	5.1	2.9
Indonesia	8.1	5.0	2.6
Italy	2.6	1.6	1.1
Japan	2.7	1.5	1.1
United Kingdom	2.9	1.9	1.5
United States	3.9	2.3	2.0

Source: Widjaja's calculations from "World population prospects: The 2006 revision population database".

New economic policies are needed to anticipate these changes, including the policies in social security provision. For countries that run an unfunded defined benefit pension system, it is projected that collected funds will not be sufficient to pay the pensions of the future elderly population. The situation threatens the sustainability of an

unfunded pay-as-you-go pension system. For developing countries that lack an established pension system, the increasing elderly population creates a strong demand for the existence of a pension system (even though some countries still rely on existing family networks). Among problems faced by countries with weak social security systems and its institutions are: tax evasion, low participation by self-employed workers, liquidity problems (e.g., the inability of the system to pay the promised benefit), embezzlement of the collected funds, and a large public debt.

Tax evasion is especially severe in many developing countries since they often have a large informal labor market that is hard-to-tax. Further, under the provision of a pay-as-you-go system, taxpayers of social security system understand that the benefits they receive are only weakly linked to the taxes paid, and they may evade the payment of social security taxes by reporting lower incomes than actually earned, since they do not believe that the taxes will be fully reflected in benefits.

Low participation of self-employed workers is a problem faced not only by developing countries but also by developed countries. One of the reasons for such low participation of the self-employed is that in a pay-as-you-go system the self-employed individual is expected to pay double for himself: once as an employee and again as an employer. For many self-employed, such double payment is considered a heavy burden on them.

The liquidity problem is caused by the miscalculation of the government's system planner regarding the taxes that will be received by the government versus the benefits that government will pay. In addition to the social security tax evasion mentioned above, the miscalculation between taxes paid and benefits received may exacerbate government

budget deficits. Corruption may contribute to this liquidity problem as well, although this is more related to the weakness of the government's budget supervising mechanism. A large public debt problem is also caused by excessive payments of social security benefits. Under a failed pay-as-you go system, governments in developing countries like Chile used public debt to finance the social security benefit.

This dissertation offers an alternative set of policies toward pension reform in developing countries, where formal and informal production and labor sectors exist. The system offered consists of three integrated programs: consumption taxes to finance a defined benefit program, a fully funded pension as a savings program, and the education of skilled labor as a support program for a sustainable pension program.

The object of research in this dissertation is the Indonesian pension system. Currently, although some state-owned pension funds and many private pension funds have been running for more than thirty years in Indonesia, there is currently no integrated pension system, run either by government or by private institutions. One state-owned pension fund runs the retirement fund of civil servants, while the private pension funds run the retirement funds for individual third pillar voluntary pensions. It is clear that Indonesia does not have solid pension institutions.

The Indonesian economy comprises vast amounts of informality in the goods, labor, and money markets. Informality in the goods market means that firms may sell goods without being registered as taxpayers. Charmes (2000) predicted that the size of the informal goods market in Indonesia is around 25 percent of total GDP in 1997. In the labor market, informality leads to employees working without contracts. Data from the Indonesian Central Board of Statistics show that around 65 percent of Indonesian

unskilled labor works in the informal production sector. Finally in the money market, informality means that lending institutions may not be registered with the central bank. Nasution (2004) explained that there are more than 6200 non-bank credit institutions in Indonesia in 1991, and he assumes that most of those credit institutions are informal.

These informal conditions, especially in the goods market and the labor market, make it difficult for central and local governments to run fiscal policies. Informality in the goods market prevents the governments from charging taxes on sales and labor income. Another implication is that firms that have employed informal labor may have no incentive to register as a taxpayer. The difficulties of the central government in running fiscal policy also imply that the central government will have difficulties in setting up a feasible and sustainable integrated pension system, especially when a pay-as-you-go system is taken into practice.

The Purpose of Research

There are four purposes of research in this dissertation. The first purpose is to study an incentive for the aging population in Indonesia to retire with a decent living by providing cash transfers for the retired population. The term "with a decent living" means that under the constant prices of year 2005, a retiree in Indonesia may earn a pension amount between USD 1 to USD 3 per day per person. In term of the net replacement rate for unskilled labor, a USD 1 cash transfer per day per person equals a 30 to 70 percent net replacement rate, depending on average wages. Also, as shown in Chapter Four of this dissertation, many Indonesians are still working after age 60 because they do not have enough funds to currently save for their pension or they did not save enough when

they were young. In terms of pension provisions, the first purpose is to provide an integrated pension system.

The second purpose is to look at the distribution of tax burdens across generations from the consumption tax for cash transfers by calculating the equivalent variations. The equivalent variation is defined as the differences of expenditure at the new utility function but different prices because of taxation. The first two purposes will be elaborated partially in Chapter Six, and the calibration results are discussed in Chapter Seven. The calibration results are also presented in detail in Appendix B.

The third purpose is to observe how the creation of skilled labor through education affects the capability of labor to finance their own pension. An increasing amount of skilled labor that is able to self-finance their own pension will release the burden of government's provision of minimum pension budget. This purpose is elaborated in Chapter Six.

The final purpose of this dissertation is to look at the economic growth impact of the pension reform by calculating the economic growth from the increase of the annual output due to the increase of skilled labor, as discussed in Chapter Eight of this dissertation.

Terms and Definitions

Several common terms and definitions are explained here to be used for the present chapter and the future ones. Definitions can be found in *Private Pensions: OECD Classification and Glossary* (2005), Rachmatawarta (2004), Edey and Simon (1998), and Feldstein and Samwick (1997).

A *mandatory pension system* is defined as a pension system where the central government requires individuals to pay a pension tax of a certain rate. A *voluntary pension system* is a pension system where an individual designs a personal pension program through a private pension institution. In terms of the width of participation, a voluntary pension system does not provide broad latitude compared to the mandatory one.

A *defined benefit pension system* is a pension system where the central government or a pension institution determines the benefit amount that individuals will receive when they retire, given a certain rate of previous pension contribution, without a clear link between the two. A *defined contribution pension system* means that the government or a pension institution determines the contribution amount that individuals must pay for their own pension, and the benefit received later is usually linked to the contribution.

A *pay-as-you-go pension system* is defined as a pension system where the central government charges a pension tax on the labor income of the current working generation to pay for the pension benefits of the current retired population. A *funded-collective* pension system means that the government charges the pension tax on the labor income of the current working generation for the payment of their own pension benefit in the future.

Privatization means that central government hands over the management of an integrated pension system to a private institution.

In general, *prefunding* means that the government improves its net assets position. *Prefunding* as in Rachmatawarta (2004) is defined as the government payment of pension benefits for the current retiree, taken from other sources of funds outside the pension

system, in the transition period of changes of pension system from a defined benefit pay-as-you-go to a defined contribution funded collective system.

Iintergenerational redistribution is defined as taxes and transfers taking place across cohorts, while *intragenerational redistribution* is defined as taxes and transfers taking place within cohorts. The two types of redistributions take place only when a mandatory defined benefit pay-as-you-go system applied in a country.

Sustainable means that the program has its ability to endogenously finance itself and run for a long term, i.e., 50 years.

The Reform on the Social Security System Taken

At present, many countries have already enacted some reforms of their social security system. These reforms are taken largely in order to save the sustainability of the program to finance itself. I classify between reform in countries with solid institutional pension systems and countries with weak institutional pension systems.

For countries with a solid institutional pension system, existing reforms include (McHale, 1999): reducing benefits (U.S.), changing retirement benefits from increasing rate benefit to flat rate benefits (U.K.), increasing retirement age (Germany, Italy, Japan, U.K., U.S.), and changing post-retirement indexation from wage indexation to price-level indexation. Meanwhile, for countries with weak institutional pension system, reforms made include (Feldstein, 1998; James, Edwards, and Wong, 2003): changing the whole system from a mandatory defined benefit pay-as-you-go system into a mandatory defined contribution funded-collective system, privatizations, and pre-funding during the transition period (Argentina, Brazil, Chile, and Mexico).

The Result of Reforms Taken on Social Security System

McHale (1999) calculated gross *social security wealth* (SSW) for a given benefit formula at certain individual ages for several industrialized countries, which are also noted as countries that have a strong institutional social security system. Social security wealth is defined as the discounted present value of implied future benefits evaluated at a given point in the worker's life. One of his findings is that there was a substantial loss for workers' SSW in observed country after the reform. Table 2 provides details of SSW changes and the reasons for these changes.

Table 2. Changes of Workers' Social Security Wealth in Several Industrialized Countries

Countries	Year of Reform took place	Percentage change in Social Security Wealth		Reason for Change
		Men	Women	
French	1993	-8.5	-10.0	Wage indexation to price indexation
Germany	1992	-2.1	-2.8	Gross wage indexation to net wage indexation
Italy	1992	-3.4	-11.2	Wage indexation to price indexation
Japan	1994	-2.5	-3.1	Gross wage indexation to net wage indexation
U.S.	1993	-1.7	-1.7	Six months of cost of living adjustment freeze

Source: McHale (1999), reprinted with author's permission.

In Table 2, the changes of indexation in the fourth column are the changes of adjustment value of the defined benefit of the pension amount. For example, in price indexation, the pension benefit is calculated subject to the changes of price level, whereas

in wage indexation the pension benefit is calculated subject to the changes of wage level. The cost of living adjustment means that the pension benefit is calculated subject to the changes of cost of living.

Studies of Social Security Systems in Developed Countries

Much previous research has been done on social security systems around the world. I review the most recent as well as the most influential work.

Country studies usually focus on the impact of a certain system of social security, or the impact of a certain reform on a social security system on macroeconomic variables such as savings, capital accumulation, and economic growth, as well as on microeconomic issues, such as labor supply, redistribution, and welfare. Broer (2002) used a computable general equilibrium (CGE) model to analyze the impact of reducing pay-as-you-go benefits on the Dutch economy. His findings are that the reduction of pay-as-you-go benefits increases equity through the decrease of pay-as-you-go contributions and the decrease of implicit lump-sum taxes on the older population. Fehr and Steigum (2002) try to simulate the application of mixed social security system - the combination of partial pay-as-you-go system and funded collective system - on the Norwegian economy, using a closed economy CGE model. Liégeois (2002) used a generational accounting model to analyze the impact of Belgium social security system on generational equity, and showed that the increase of the aging population in Belgium could increase tax rates on wages by 8 percent under a pay-as-you-go system. Cavalletti and Lubke (2002) use the applied general equilibrium (AGE) model to compare the impact of the 1992 Amato reform and the 1995 Dini reform on Italian economy. The

1992 Amato reform basically changed the benefit calculation from price indexation to wage indexation, while the 1995 Dini reform changed the pay-as-you-go with defined benefit system into the pay-as-you-go with a notional defined contribution system. Their findings are several: the reforms should be able to produce a lower ratio of pension expenditure to GDP, but the simulation results highlight some problems poised by adverse demographic trends in combination with the pay-as-you-go pension scheme.

The studies on social security systems also focus on many specific economic aspects. There are studies on distributional aspect, i.e. the impact of a certain social security system on the intergenerational redistributions and the intragenerational redistributions. For the US case with a pay-as-you-go system, such studies include ones by Bennett (1979), Hurd and Shoven (1985), Boskin, Kotlikoff, Puvert, and Shoven (1987), Feldstein and Samwick (1992), and Liebman (2001). Bennet showed that the rate of return from pay-as-you-go pension system for family pension taxpayer is higher than that of single. Hurd and Shoven showed that there exist transfers among cohort in the US pay-as-you-go system. In other work at almost the same time, Boskin et al. showed that there exist intergenerational redistributions as well as intergenerational redistribution in the pay-as-you-go system in the US, and the rate of return is positive for at least the older generations. Feldstein and Samwick showed that the marginal tax rate on social security earning fell highest on women with a dependent spouse and were negative for men with a dependent spouse. Liebman showed that the progressive rate of return on the US pay-as-you-go system depends not only on life-time earnings but also on other factors such as marital status and life expectancy.

The impact of a pay-as-you-go system on the fertility of the European countries population and US population was analyzed by Boldrin, De Nardi, and Jones (2005). They found that the application of a social security system in the US and Europe stimulated parents to reduce the fertility. The higher the social security benefits, the lower the fertility rates. Engelhard and Gruber (2004) observed the impact of a pay-as-you-go system on the poverty of elderly population in the United States, and found that the impact of pay-as-you-go in the poverty alleviation of older population in the US is positive.

At present, research on social security systems and human capital is rare. The most recent study that relates social security to human capital is by Ehrlich and Kim (2005). By observing 57 countries over 32 years, they found that the implementation of pay-as-you-go systems had an adverse effect on human capital formation. In their regression method, they used three variables as dependent variables: the average schooling year in population, the secondary school enrolment rate, and an international test score measure. They found that social security had a negative impact on these measures of human capital. Erlich and Kim also found that the system had adverse impacts on family formation, fertility, and GDP per capita. The pay-as-you-go system decreased marriage rates and increased divorce rates, it discouraged families from having children, and government pension spending had an adverse effect on GDP per capita.

Studies of Social Security Systems in Developing Countries

The seminal work for analyzing the issues of pension policy in developing countries is by James (1994). She proposed that countries with dual labor markets,

including formal and informal sectors, should separate the purposes of redistribution and the contribution-benefit link in running a pension program. In terms of policy matters, the government is able to require taxes from workers and corporations in the formal sector but not from those in the informal sector. Her suggestion is that governments in developing countries should not implement a pay-as-you-go pension system, as pay-as-you-go systems combine the distribution purpose and savings purpose.

There are several reasons behind James' suggestions. First, there is not sufficient labor income in the formal sector to be charged for pension taxes. Thus, the tax amount collected would not satisfy the minimum benefit amount distributed to the whole pensioners from both formal and informal sector workers. In many developing countries, the amount of labor in the formal sector is much smaller than that in the informal sector. Second, there is no government guarantee in the future about the benefit received by the contributors in the formal sectors that links to their contribution. The second condition is predicted to lead to the evasion of social security contributions by workers in the formal sector, either by suspending their participation or by moving to the informal sector.

James also proposed a type of multi-pillar system for pension programs in the developing countries. The first is a universal social security system that break links between benefit and contribution and covers everyone, i.e., all the retirees, from both formal and informal sectors, and people who never went into the labor force in their life. The first pillar is run by the government. The second pillar is a compulsory fully funded defined contribution program for employees within certain brackets of income, which is usually designed for employees who work in the formal sector and run by the government. The third pillar is an additional voluntary fully funded defined contribution. Since it is

voluntary, the program will be run by private institutions, and will be followed only by certain employees in certain income brackets.

There is a great deal of literature about the experience of developing countries in running pension programs. Linciano (2000) reviews theoretical issues and empirical evidence from four different countries. Among these four countries, two are developing countries: Chile and Argentina. Having suspended its unsustainable pay-as-you-go system, Chile changed its pension system to a mixed system between fully funded and pay-as-you-go, with the fully funded making about 87 percent of the total benefit (James et al. 2003). Chile's revised pension program is a mandatory fully funded individual retirement account. Still, the government guarantees a minimum pension to participants below a poverty line. Similarly, the pension reform in Argentina comprises a mixed system between a private fully funded system, called capitalization regime (CR) and the traditional pay-as-you-go system. The obvious advantage is the eligibility for the basic benefits for male workers. Individuals are free to choose CR or the pay-as-you-go system.

Another example of a developing country with formal and informal labor sectors is Brazil (Filho, 2005; Giambiagi and Mello, 2006). The Brazilian pension system is a pay-as-you-go system with retirement contributions to the program paid by contributions from both employees and employers. The Brazilian government also provides a minimum pension benefit to employees, and no contribution is required for someone to be eligible to receive benefits. Still, with the formal-informal labor market conditions, there exists movement of labor from the formal labor market to the informal one.

Other studies are the pension reform in China (Agarwala, 1997; Dunaway and Arora, 2007; Yuan and Feng, 2004).China's pension system faced short-term as well as

long-term problems. The short-term problem is the large amount of pension payments required for the enormous number of Chinese civil servants. The long-term problem is China's rapidly increasing aging population. To cope with these problems, China reformed its pension system in 1997. The reform comprises three pillars. The first pillar is the traditional pay-as-you-go system where the government charges a tax on the employers for the benefit of the employees. The second pillar is the mandatory fully funded pension, paid by both employers and employee. The third pillar is the voluntary fully funded pension. It is not clear at this point that these reforms have addressed the short- and long-term problems.

There are not many studies on the redistribution effects in developing countries. One good case of a mixed system between a pay-as-you-go and a funded collective system is James et al. (2003) on Argentina, Chile, and Mexico. Their research looked at the distribution impact of pension reforms by gender. Their findings are that in the three countries, women accumulated private annuities more than men after the reform. However, this effect took place only because the new public pension pillar targeted the low earner population, many of whom were women. As a result, low earning married women were the biggest gainers from the pension reform.

There are also studies on the impact of social security reform on labor supply. One excellent study is Edwards and Edwards (2002). They analyzed the impact of social security reform on the labor market in Chile. Their findings are that reduction of job security, decentralization of workers collective bargaining, and the privatization of social security altogether reduced unemployment by 1 to 1.5 percent.

All of the studies discussed above show that there are two important things to consider when applying a pension program in developing countries. The first is the sustainability of the pension program by looking at how the program financed itself. The second is protection of the formal labor market from the movement of labor into an informal one.

The Research Question

The purpose of this dissertation is to examine the sustainability of an integrated pension system for Indonesia, which may include a savings motive and a redistributive motive. Sustainability here is defined as a system that can run in a long term. The research question of focus is: Given the current state of the traditional economy in Indonesia, where informal production and informal labor markets vastly occupy the economy, how can a sustainable pension that achieves an increasing formal labor market be designed and established?

The Methodology

Following the four purposes of dissertation, there are two methods applied. In order to achieve the first and second purposes of the dissertation, I apply a computable general equilibrium (CGE) model of overlapping generation (OLG) developed by Auerbach and Kotlikoff (1987). The software to be used in the model formulation is generalized algebraic modeling system (GAMS). The written program for OLG-CGE in GAMS is called the mathematical programming system for general equilibrium analysis (MPSGE), developed by Rasmussen and Rutherford (2004). Meanwhile, heterogeneity of

households in the model follows the one authored by Rausch and Rutherford (forthcoming). The attach-to-GAMS solver to be used for solving the simultaneous equations in the model is called a mixed complementary program (MCP), developed also by Rutherford. Meanwhile, some parameters are estimated using econometric techniques, with STATA software.

In order to achieve the third and fourth purposes, I apply an econometric method combined with a linear algebra method. The econometric method is applied for estimating the elasticity of government expenditure to skilled labor creation. The software for the empirical work is STATA, and the software for the linear algebra calculation is Microsoft Excel.

The Outline of Dissertation

The organization of the chapters is as follows. There are nine chapters in the dissertation. Chapter One contains the fact of worldwide aging problems as a background of pension reforms. This chapter also contains many reforms in pension policies that have been taken worldwide, especially in the developing countries where formal and informal production sectors and labor sectors exist. Studies of many types of pension systems and reforms and the impact of aging population on pension are also discussed here.

Chapter Two discusses the characteristics and performances of many types of pension systems, such as pay-as-you go versus fully funded, defined benefit versus define- contribution, in both theory and practice in the developing countries.

Chapter Three contains a short discussion based on Law No. 40 /2004 of the reform of Indonesian pension, which is a reform from the Pension Law No. 11/1969. The

most important reform is pre-funding for all type of workers coverage, either workers in the private sector or public sector, skilled and unskilled. This pre-funding issue is the one that I translate as a cash transfer redistribution financed from consumption taxes.

The characteristics of workers and retirees in Indonesia are discussed in Chapter Four. I develop a small open economy overlapping generation model for the Indonesian mandatory pension system based on these characteristics of Indonesia. There are two layers in the model. The first layer is a cash transfer for low income retirees, financed from a consumption tax. The second layer is a mandatory fully funded pension. It is expected that the cash transfers will be diminished gradually as workers are able to self-finance their own pension through the fully funded pension.

Chapter Five contains the analysis of data and the regression estimation of parameters used in both linear algebra and CGE model. The macroeconomic data are taken from the Indonesian year 2000 Social Accounting Matrix and various years of GDP reports. The data on labor characteristics are taken from Central Board of Statistics Indonesian Annual Labor Situation, various years. The data of the central government budget are taken from the Annual Report of the Ministry of Finance.

Chapter Six includes the presentation of the budget impact of cash transfers and the impact of skilled labor creation on government budget. The creation of skilled labor is an important aspect in creating a strong pension system, either a defined benefit or a defined contribution. The creation of skilled labor through university education will erase the budget impact of cash transfer pensions and contributes to economic growth. Chapter Seven discusses the result of calibration analysis. The calibration results consists of the welfare distribution of tax burdens among generations and the amount of labor in the

economy after the central government set consumption tax for cash transfer program. The impacts of skilled labor creation, consumption taxes for the defined benefit pension, and the fully funded savings pension program on economic growth are discussed in Chapter Eight. Finally, the conclusions follow in Chapter Nine.

The Brief Summary of Results

There are three types of results presented in Chapters Six, Seven, and Eight of this dissertation. In Chapter Seven, I present some calculations regarding the impact of skilled labor creation through university education on the central government budget. The result presented in Chapter Seven is the calibration result on distribution of tax burden across generation and the amount of labor after consumption tax for cash transfers and after fully funded pension setup. Chapter Eight discusses the impacts of education spending up to the university level, consumption taxes for defined benefit pensions, and the fully funded savings pension on economic growth.

The results presented in Chapter Six regarding the skilled labor creation are several. In order to eliminate 1.25 percent of unskilled labor every year, the central government should increase its education expenditure by a minimum of 8 percent of the annual budget from the previous less than 2 percent. The amount 1.25 percent of unskilled labor is a proposed long run government program to eliminate 25 percent of unskilled labor within 20 years. Currently, the central government has already increased the average education expenditure to 4 percent annually. To increase education expenditures to 8 percent of total government budget is an affordable task for the Indonesian government. One way to achieve that target is by reducing the subsidy for

consumption in Indonesia. From the year 2000 social accounting matrix, it is informed that although the consumption tax rate reached 7.5 percent of total consumption, the subsidy rate is actually slightly more than the tax rate. Therefore, reducing the consumption subsidy is one way to change the pattern of government expenditure. In addition, the creation of skilled labor will make laborers better able to finance their own pension savings and thereby lessen the burden of pension cash transfers from central government budget. It is expected that the creation of skilled labor, by eliminating 25 percent of unskilled labor, will save the government budget by Rp 100 trillion of cash transfers in year 2040.

Chapter Seven presents two calibration results. The calibration results consist of the calculation of distribution of tax burden across generations and also the amount of labor supply before and after the taxation. Both results are calibrated under assumption that laborers are able to adjust their working hours. Another important assumption is that Indonesian economy is assumed to be a small open one. Either capital income financing or labor income financing has the same welfare impact of taxation under optimized working hours, from USD 1 per day per person cash transfer to USD 3 per day per person cash transfer. The calibration of the labor amount before and after the increase of consumption tax burden is also presented. The USD 1 cash transfer increases the largest labor amount in the economy, both skilled and unskilled. For the setup of the fully funded pension plan, 100 percent of labor income financing achieves the largest amount of labor in the economy, for both skilled and unskilled labor.

Finally in Chapter Eight, education spending up to the university level in order to eliminate 25 percent of the size of informal labor sectors would increase the GDP by 3.1

percent. However, the consumption taxes and the fully funded pension taxes would likely decrease the current economic growth but increase the future one.

CHAPTER TWO

The Social Security System: Characteristics and Performances

There are four ways to classify social security systems. One way is to classify how people support themselves when retired, a classification known as “pillar systems”. Another way is to explore how the social security funds are collected. A third way is to discuss which part of the payment is defined by the government, either the contribution (defined contribution) or the benefit part (defined benefit). One last classification is whether the social security payment is obligatory or not.

Utilizing the pillar system (James, 2004), I divide the system into three pillars. It is called the pillar system because it explores which source (s) of income supports the living of the retired. The first pillar is known as the “public mandatory unfunded pay-as-you-go” pension plan. The second pillar is the “mandatory funded collective” pension plan. The third pillar is known as a “voluntary private” pension plan. Table 3 elaborates more details regarding the pillar system.

From the classification of collecting funds, we divide the social security system into “unfunded” versus “funded” (Blake, 2000; Feldstein and Liebman, 2002; Kuné, 2001; Sinn, 2000). Unfunded means the government charges taxes on the wage income of the current working generation and transfers the funds as benefits to the current retired generation. The unfunded system is also known as the pay-as-you-go system. Funded means the central government (or any private institution on behalf of the government) charges a tax on the wage income of current working generation, deposits the funds into an asset market to earn annuities from it, and then in the future pays back the principal

and its accumulated annuities to the same person when s/he becomes retired. Readers may refer to the Appendix A for additional information regarding the plan.

Classifying the system into benefits and contributions, the social security system may be divided as “defined benefit” versus “defined contribution”. Defined benefit means that the central government sets a certain standard for benefit payments for the older population. This system is usually connected to the pay-as-you-go system. Defined contribution means the central government sets a certain standard for contribution payment from the working population. A defined contribution system is usually linked to the funded collective system (Feldstein and Liebman, 2002).

As the central government determines pension payment obligation, a social security system may be classified as “mandatory” versus “voluntary”. The central government sets an obligation for the working generation to pay the social security taxes in the mandatory arrangement. Individuals set their own pension accounts at private pension institutions, and set their own pension payments according to their agreement with the institutions in a voluntary arrangement.

The definitions that I discuss are introductions to further discussions in Chapter Two regarding the characteristics and performances of each system. Performances relate to characteristics and the social economy of the country where it is applied. In later sections of Chapter Two, I elaborate the application of pension systems in the developing countries as examples of performances of social security systems related to their characteristics.

Table 3. The Pillars of Old Age Income Security

	Mandatory Publicly Managed Pillar (1)	**Mandatory Privately Managed Pillar (2)**	**Voluntary Pillar (3)**
Objectives	- Co-insurance - Redistribution	- Co-insurance - Increase savings	- Co-insurance - Increase savings
Form	- Flat - Means-tested - Minimum pension guarantee	- Personal savings plan - Occupational plan	- Personal savings plan - Occupational plan
Financing	Tax financed	Regulatory fully funded	Fully funded

Source: James (2004)

Characteristics of the Social Security System

It is important to study the characteristics of the afore-mentioned social security system. By studying the characteristics, we are able to know how the implementation of each system affects the welfare of a given society. Below is the elaboration of the characteristics of each system. I elaborate the characteristics of an unfunded pay-as-you-go system compared to a funded collective system, and a defined benefit system in comparison with a defined contribution system.

Unfunded and Funded System Characteristics

Characteristics of a Mandatory Unfunded Pay-as-you-go System There are five important characteristics of a mandatory pay-as-you-go system that are important for policy analysis in order for the system to work well (Blake, 2000).

The first characteristic is a defined benefit, and it weakens the link between contributions and benefits as in fact it is possible that the individuals gain more benefits than what they paid in contributions. The first characteristic is strongly connected to the second, or the size of formality of the labor market. A large formal labor sector is important in implementing the pay-as-you-go pension program because a formal labor sector means the central government has access to charge taxes on labor. Let us assume that taxpayers understand how the system works, and assume that there is a large amount of informality in the labor market. The workers in the formal labor sector would then move to the informal labor sector, avoiding government taxes, as they would understand that the pension benefits received are lower than the contributions paid.

A third characteristic, intergenerational distribution is defined as the distribution of income from higher-income individuals to the lower-income individuals across cohorts. Intragenerational distribution is defined as the distribution of income from higher-income individuals to the lower-income individuals in the same cohort. These third characteristics take place because of the defined benefit characteristic noted above.

The fourth characteristic is that the pay-as-you-go system has the joint purpose of savings and redistribution. Savings and redistribution are not separable in the system as the contributions paid are not earmarked taxes because the current working generation pays the pensions of the current retired generation. The redistribution takes place among the retirees while savings take place among the working generation.

The fifth characteristic is the sustainability of the system due to population aging. As the system includes the transfer of income from the working generation to the old generation, a decline of the working generation relative to an increase of the retired

generation will cause the amount of income transfer to become relatively smaller. Eventually, the amount may not be sufficient to be distributed to the retired generation.

Characteristics of a Mandatory Funded Collective Plan. To make a parallel comparison with the pay-as-you-go system, I include five important characteristics of the mandatory funded collective plan that are similar to the pay-as-you-go characteristics mentioned above.

Defined contribution, the first characteristic, strengthens the relationship between the contributions paid and the benefits received. Under a defined contribution plan, individuals open their own pension account and set the monthly amount paid. Under certain contracts when retired, the same individuals collect the benefits from their own account. They can then calculate the benefits received from the contributions paid and calculate the relationship between the two.

Like the pay-you-go system, the funded collective plan works best under a formal labor market. The funded collective system needs continual monthly deposits from the contributors, i.e., the people involved have stable incomes. The formal labor sector guarantees that labor have a steady income, compared to those who work in the informal labor sector.

Since benefits in the funded collective system are received by the same individuals who contributed, then it has a savings, rather than a redistribution, motive. Moreover, there is no impact of an aging problem on the system because the contribution does not depend on the current working generation but had already been paid in the past by the same individuals.

Defined Benefit and Defined Contribution System

Defined Benefit (DB) Plan. A defined benefit (DB) plan offers an assured income replacement ratio in retirement. Still, this is the case only for workers who remain with the same employer for their whole career. Blake (2000) found that in the UK, average workers change jobs about six times in a lifetime. Every time workers switch jobs, they experience a ”portability” loss in respect to their pension entitlement. This is because DB plans are generally provided by specific employers, and when workers change jobs, they have to move to a new employer's plan.

Defined Contribution (DC) Plan. According to Blake, the characteristics of a defined contribution plan have two different stages: the accumulation and the decumulation stages.

The Accumulation Stage

- DC has the advantage of complete portability when workers change jobs. However, individual DC schemes tend to have much higher operating costs than occupational DB schemes. Occupational DC schemes have lower operating costs than occupational DB schemes due to structural simplicity.
- Individual DC schemes, although portable between jobs, are not fully portable between plan providers or even between different investment funds operated by the same provider.
- Total contributions into the DC plans tend to be much lower than the ones into the DB plans.

– DC plans have explicit (contributor burden) asset risks and other types of risks, such as ill-health, disability, and death-in-service. In DB plans, these risks are carried by the plan sponsor, not the retiree. This implies additional cost for workers to purchase insurance to gain such protection.

The Decumulation Stage

Private sector DC plans will generate a high amount for retiree *only* if the annuities market works well. In that context, the value of pension assets will be positively related to the value of financial assets. Meanwhile, financial asset markets contain volatilities, from future investment return, real earning growth rates, and inflation rates.

The Summary of Social Security System Characteristics

To summarize, we may ask several questions as to why a certain social security system or combination of several systems might be implemented.

The first question concerns why a government usually sets a mandatory pension system. There are several reasons why mandatory pension may be chosen. The first is to force people to protect themselves for retirement, reducing the burden of the government and society as a whole. Another reason is to smooth the consumption of the older population. Finally, the system protects the older population from external shocks (e.g., the 1997 financial crisis in Indonesia). Table 4 presents a summary of the relationships between pension systems.

Table 4. The Cross Table of Social Security System

	Funded	**Unfunded**
Defined contribution	Employees have individual investment accounts to which they and/or their employers make periodic deposits. Countries applying the system: Chile, Mexico, Argentina and Australia	Employees credit individuals' account with the taxes that they and their employers pay and then accumulate these sums with an implicit rate of interest. Countries applying the system: Sweden and Italy.
Defined benefit	Companies accumulate funds in pension accounts and pay benefits to retirees Countries applying the system: U.S. (states government and corporate pension plans)	The current working generation is being taxed, and the amount is paid to the current retired generation Countries applying the system: U.S. and most European Countries

Source: Feldstein and Liebman (2002)

The second question is which system governments typically choose. There are three economic reasons for choosing a pay-as-you-go system: it has redistribution effects, it serves as co-insurance for the older population, and it has low administrative costs because of the economies of scale of running a large pension program that applies to most individuals.

There are four economic reasons for choosing a funded system. First, a funded system tends to increase national savings. Second, it may develop a capital market during the implementation, since the collected fund must be invested in the asset market in order to get annuities. However, the second reason does not take place in all countries because it still depends on how the government develops the capital market. In addition, like a pay-as-you-go system, it also serves as co-insurance for the older population. Finally,

because it is flexible in terms of provision, it is not affected by the demographic situation (i.e., aging population).

The Performance of Social Security Systems

For the purpose of reform, we should evaluate the performance of each system during their implementation period. In addition, evaluating performance is one way to compare the empirical facts with characteristics previously mentioned. There are three principles for performance evaluation. The first principle is individual equity: the present value of the taxes paid and the present value of the benefit received in the future are at least equal for individual. Redistribution as the second principle comprises redistribution within cohorts (intragenerational redistribution) and redistribution across cohorts (intergenerational redistribution). The third is the impact of each system on economic growth, including the function of each social security system in poverty alleviation.

The Performance of the Mixed System. A mixed system that combines the mandatory unfunded pay-as-you-go system with the mandatory funded collective is mostly implemented in South American countries (e.g., Argentina, Chile, Mexico). Even though it is defined as a mixed system, the funded collective plan is usually more dominant than the unfunded plan. For each country, more than 80 percent of accumulated funds go into the funded system. This is because the system has often replaced the traditional pay-as-you-go system that was run in those countries before the reform but that collapsed because of institutional weaknesses.

Edwards and Edwards (2000; 2002) found that the implementation of a mixed system in Chile increased the wages of labor in the informal sector by 2 percent. The

reform itself made contributions in the reduction of Chile's aggregate unemployment, even though small. James et al. (2003) discussed the changing effects of a mixed system in three countries, Argentina, Chile and Mexico. The most important finding is that the reform significantly increased the welfare of the under-educated workers, especially women. Women also received more from redistributions than men did after the reform.

The works of Edwards and Edwards and James et al. on mixed social security systems show that the reform of social security systems in Latin America is able to increase the welfare of the population. The success of funded systems in Latin America in some ways suggests that countries with a pay-as-you-go pension system should change to funded systems, given the current decline of the amount of working population that threatens the sustainability of most unfunded pay-as-you-go systems.

The Summary of Social Security Systems' Performance

By observing the performance of each system, it can be seen that each system has made positive contributions towards the welfare of the population of each country. I conclude that the real problem of implying a social security system is not that one system is better to another, but whether and how well each system fits the socio-economic and demographic conditions of each country and the level of solidity of administering pension institutions. Without such awareness, implementation of social security systems will only face similar troubles to those seen in the Latin American countries, such as under-reported incomes, huge implicit debt, funds embezzlement, failure to pay pension benefits, and the like

CHAPTER THREE

The State of the Indonesian Social Security Program

Indonesia, the fourth most populated country in the world, is a country in crisis. It was hit by the Asian financial crisis in 1997. Within two years after that, the financial crisis grew into a broader economic crisis. There were four Asian countries hit by financial crises at the time – Indonesia, Malaysia, South Korea and Thailand – but only Indonesia could not get out of the crisis until recently.

The explanation is because the Indonesian government is poor, it lacks funds to thwart the crisis, and the population is also quite poor. Corruption is rampant. At the time, the Indonesian people lack the public life-support in terms of the availability of well-paid jobs, a low provision of public education, a low provision of public health care, and the lack of a social security system for the retired population. Even today, the poverty rate in Indonesian regencies (comparable to county levels in the US government structure) is over 80 percent of the population living below the poverty line. However, per capita income has grown up to USD 1280 per capita in 2005 from USD 972 in 1998 (*World Development Indicators 2006*, 2006), exceeding the level at the beginning of the crisis.

One of the results of the economic crisis was that it forced changes in the political regime in Indonesia. Before, the Suharto regime controlled all the public and government institutions, from Parliament to the judiciary. Today, the political situation in Indonesia is more democratic. The political parties are not controlled anymore, and people are able to vote freely for the President as well as the Parliament. The judiciary has also become more independent, and the Parliament is now focused more on the public interest by generating legislation that is helpful for the public, such as pension law.

There are two important laws regarding pension in Indonesia. They are Law No. 11/1969 about the pension for civil servant and Law No. 40/2004 about the national social security system. Although it still has no sub-implementation law, Law No. 40/2004 reforms a national pension system. Before, even though pension institutions existed in Indonesia, there was no integrated pension system. In addition, according to population projections by the United Nations, Indonesia faces a rapidly ageing population, and Law No. 40/2004 is important in facing this aging phenomenon in Indonesia.

The commonly used indicator for ageing is the ratio of working population (age 15-59) to elderly population (age 60+). For Indonesia, in year 2000, the ratio is 8.1, so that there are 8 workers able to support the pension benefit of 1 retiree. In 2025, the ratio is projected to decline to 5.0, and to 2.6 in 2050. The trend is declining for the next 50 years.

Currently, there is no mandatory pension system in Indonesia. Voluntary pension programs are many, offered by many private pension funds. The Indonesian government itself has four state-owned social security enterprises. Those are PT. Jaminan Sosial Tenaga Kerja (Jamsostek, a life insurance for private sectors worker), PT. Tabungan Asuransi Sosial Pegawai Negri (Taspen, a pension institution for the civil servants), PT. Asuransi ABRI (Asabri, an insurance and pension institution for the member of armed forces), and PT. Asuransi Kesehatan (Askes, a health insurance institution).

Description of the Proposed System

The proposed framework as stipulated in Law No. 40/2004 consists of the following:

1. Five mandatory programs, namely work-accident protection, life insurance, provident fund, pension, and health maintenance programs.
2. All-worker coverage, including informal workers, with gradual inclusion.
3. Pre-funding for all programs.
4. A tripartite board to assist the President in formulating policies on a national social security system.
5. Several state companies to run the program.

The Mandatory Programs

Among the five proposed programs, the provident fund and the pension program are the most relevant to discuss. In the proposed programs, employers and employees would pay contributions to the provident fund. The rate of contributions would be determined by a set of government regulations. Benefits are the accumulations of contributions with interest. They will be paid in lump sum as early as five years before normal retirement age. Participants may borrow from the provident fund by pledging their benefits. However, this type of borrowing can only be done after a certain minimum period of participation.

The proposed pension program is a defined benefit type. A participant will be entitled to monthly pension if s/he has at least 15 years of contribution. The benefit formula will be prescribed in government regulations, and minimum benefits will also be set. If someone contributes for less than 15 years, the incumbent will only get accumulated contributions. The pension program will also require contributions of equal proportions from employers and employees, as determined in government regulations. It

is not clear how the rate will be adjusted to respond to the potential emergence of surpluses and deficits.

Critical Review on the Proposed System

Below are critical reviews of the current law, according to Rachmatawarta (2004). By the time the critical views were issued in year 2004, he had become the Director of Pension Funds, Ministry of Finance, Republic of Indonesia.

1. The proposed provident fund is designed very much like existing provident funds under the current Jamsostek program. As benefits are paid in lump sum and may even be withdrawn prior to retirement, the program is very unlikely to maintain income after retirement. The possibility of pledging the benefits for cash borrowing will even hamper the intention to provide protection of income during old age. Experience shows that many people tend to cash in their financial rights as soon as possible if they are allowed to do so, and soon use up the money unwisely.

2. It can be argued that the purpose of providing lump sum benefits upon retirement under the provident fund program competes with the purpose of severance payment as required by the labor law. If so, both employers and workers have to set aside funds for the same purpose. Unless substitution of benefits is allowed, having two similar programs prescribed in two different laws demands further cost and benefit analysis.

3. Fifteen-year vesting under the proposed pension program is of course better than 20-year vesting under the current civil service pension program. However, it is still a very long vesting period compared to the one prescribed in Law No. 11/1992 on pension funds. This long vesting period may demote the pension program in the wider framework of old age income protection. A mandatory pension program should be able to offer an income floor for as many persons as possible (with the risk of higher level of funding).

4. Opting-out from the provident fund and pension programs will not be allowed. It will discourage employers who already have a voluntary pension program to sustain the program. The total costs for the pension promises will become too high for employers to bear. As pension benefit formula and level of contributions to the provident fund are not prescribed in the draft law, so that an early assessment of total costs is not possible. If pension benefits and provident fund contributions are set high in government regulations, the existence of a voluntary pension program will definitely be adversely affected. Employers will tend to satisfy their obligation to the mandatory program before thinking of funding a voluntary one.

5. Charging and collecting pension contributions with variable rates will be very difficult. Socialization of the rates of pension contributions will have to be carried out regularly. Employers and workers will ask for frequent adjustments in contributions, which may have to be made due to surplus/deficits of the programs. They may even become very sensitive to financial conditions of the program.

6. Policy and strategy to maintain the financial health of the pension program are only vaguely described in the draft law. As mentioned earlier, no description has been made on who will be responsible for any deficits that would occur, although it seems clear that government will likely be held responsible to deal with emerging deficits. The likelihood is more obvious if the program to cover informal and poorly remunerated workers.

7. Confusion shall be anticipated in transforming the existing endowment insurance plan for civil servants and members of armed forces to either the provident fund or the pension program. Transformation to the provident fund will involve actuarial calculation of individual rights and replenishments of any deficits. It is the government who should cover the deficits. On the other hand, transformation to the pension program will need socialization regarding a change in the method of benefit and payment. The majority of civil servants and members of the armed forces will want to preserve the lump sum payment of endowment insurance benefits, instead of having only the monthly pension.

8. The lack of a clear transitional plan from various existing programs to the proposed system will create uncertainty among the management and employees of PT. Taspen, PT. Asabri, and PT. Jamsostek. Private employers and workers will also be encouraged to evade paying contributions for Jamsostek program.

9. Commercial interest of banks and life insurance companies on pension provision will be affected. They may argue against the proposed social security system, and in

10. Taxation of contributions and benefits is not described. The companies managing the programs may not be taxed at all. Although it is understood that taxation is more appropriately taken care of within tax legislation, proper descriptions of a general framework of taxation may avoid ad-hoc treatment that frequently happened in the implementation of the Jamsostek program, the pension program, and endowment insurance plan for civil servants and members of armed forces as well as voluntary private pension programs. Ad-hoc treatments may have contributed to the lack of motivation to participate in pension programs.

Matching the Simulation and the Reforms

Compared to Law No. 11/1969, there are two reforms of the pension system in Law No. 40/2004. The first one is the coverage of a pension for all workers, including those who work in the informal sectors. The second reform is the prefunding of the pension system. As has already been noted in Chapter One, prefunding means that the government finances the pension benefit of the workers not from the pension tax but from

other tax sources, such as consumption taxes. A consumption tax is a policy that can be taken in the short term by the central government to provide a minimum amount of pensions. This is the redistribution part of the simulation, which is also the first part of simulation. I demonstrate how this type of tax and transfer affects labor amount in the formal production sector, for both skilled and unskilled labor. Meanwhile, the building block of the long run pension program is a fully funded program. The second part of the simulation is how the fully funded savings pension system affects the composition of labor, skilled and unskilled, in the formal production sector. The simulation is done by assuming that both skilled and unskilled labors have control over their working hours as the central government sets consumption taxes.

CHAPTER FOUR

The Overlapping Generation Model

The model used is the Overlapping Generation (OLG) model with heterogeneous agents, labor in the formal sector, and labor in the informal sector. The OLG model itself follows the initial work of Auerbach and Kotlikoff (1987). The heterogeneous OLG is considered an apt OLG model to catch the picture of developing countries with a dual economy, formal and informal sectors of labor and goods markets. Avitabile (2003) presents examples of modeling informality with heterogeneous agents.

Neri (as cited by Filho, 2005) suggested that the main difference between formal and informal jobs concerns taxes and labor costs. In Indonesia, where tax evasion is very high due to the low law enforcement, employers choose to do business in the formal sector only if their firm is sufficiently large (e.g., employment exceeds 10 employees with sufficient capital), so that the government is able to deal with them and charge them taxes, or only if the firm wishes to be in the formal sector, say, to get the bank lending with low interest rates. This behavior explains the vast amount of labor in the formal sector (65 percent of the total labor).

The main purpose of this model is to construct the consumption behavior of the Indonesian household members among young workers (age 21-55) and old pensioners (56-65). As has been shown by Cameron and Cobb-Clark (2001; 2002; forthcoming), the characteristic of a typical family in Indonesia is co-residing between the young worker and the older parents. They also show that there are cash transfers from the young to the old. Still, they also found that the Indonesian older population is often working at the age

when they are supposed to retire. They found that the co-residency is only part of the culture, which could break down in the future, while the amount of transfers might be too little to support the need of the old. United Nations made estimates that by the year 2025 the Indonesian aged population (age 60+) will be increased by 100 percent, while the amount of total population will decrease.

I use the model to simulate proposed reforms of the Indonesian pension system. Before we proceed, readers may ask what is so important about the pension program for Indonesian retired population. Table 4.1 reveals that pension income is the largest amount of income of the retired population, whether they continue to work or retire after the retirement age 55.

Table 5. Indonesia Men's Monthly Income (Thousand Rp.)

	Age Group		
	41-55	**56-65**	**66-75**
Employed in 1993			
Median own labor income	133.1	54.9	33.2
Fraction receiving any other income (%)	83	90	89
Fraction receiving any other labor income (%)	64	68	64
Median per capita other labor income	16.2	11.4	12.2
Fraction receiving transfers (%)	54	64	66
Median per capita amount transferred	3.1	3.6	3.6
Fraction receiving pension income (%)	2	6	6
Median government pension amount	274.6	255.9	213.3
Number of observation (people)	1393	527	202
Not Employed in 1993			
Fraction receiving any income (%)	85	91	89
Fraction receiving any other labor income (%)	61	59	54
Median per capita other labor income	27.4	27.1	26.2
Fraction receiving transfers (%)	52	62	60
Median per capita amount transferred	2.3	6.0	8.6
Fraction receiving pension income (%)	15	38	25
Median government pension amount	151.3	235.2	217.9
Number of observation (people)	54	106	102

Source: McKee (2006), calculated from the Indonesian Family Life Survey 1993. Table is reprinted with author's permission.
Note: the average exchange rate: in 1997 1USD = Rp. 2500, in 1993 1USD = Rp. 2000.

Because pensions are the largest amount of income, and by itself the largest portion of income for the retirees, it becomes the most important source of income for the retirees. Most pension income is received from the government. Table 4.1 shows that the group of people who continue to work at the age they are supposed to retire usually do not receive pension income. Table 4.1 also shows also that only 6 percent of people still employed in the age group 56-65 received pension income, compared to 38 percent of those not employed of the same age group. Therefore, it is important to propose a pension program for Indonesia.

The integrated system proposed in the model consists of two pillars. The first pillar is a minimum subsistence cash transfer plan from the central government, with a defined benefit characteristic for the minimum physical needs of the retirees. The program is needed at least in the short run. The second is a long run mandatory fully funded savings plan that links the contribution and the benefit. Brook and Whitehouse (2006), in evaluating the performance of pension system in Turkey, state the importance of an integrated pension system for an economy with formal and informal labor sectors.

The two systems are proposed together since I separate the redistribution purpose of applying a defined benefit system, from the purpose of strengthening the link between contributions and benefits that exist under a fully funded system. Corsetti and Schmidt-Hebbel (1997) state that the separation between the two gives a third implication: the replacement of the implicit intergenerational debt of a pay-as-you-go system by an explicit personal debt in the fully-funded system.

The source of funds for redistribution are assumed to be taken from an indirect tax like the consumption tax, either value added taxes (VAT) or excise taxes, since these

kinds of taxes break the link between the benefit and contribution that exists in the mandatory pay-as-you-go system. The logic behind the choice of a consumption tax is straightforward. A consumption tax, either a gross receipts tax, a sales tax, or a value added tax, reduces consumption of the consumers who have income. From the macroeconomy perspective, by taxing the consumers' budget and transferring the amount to the population in need, the central government does not reduce the whole consumption but redistributes the income.

Using other kinds of taxes to finance a defined benefit plan will bring many issues to the program. Using income and payroll taxes to finance such a program brings the issue of the link between the contribution and the benefit. Taxing corporate income to finance a defined benefit plan will make many firms operating in the formal sector move to the informal sector, while taxing payroll income stimulates labor to do the same. Taxing capital income especially in a developing country like Indonesia, is also very difficult. The property tax is a possible choice, but these taxes are collected by local governments.

Regarding the pension program that links the contribution and the benefit as a second pillar, I simulate the application of mandatory fully funded system in the formal sector. This is the building block for the long run pension program in Indonesia.

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The Model

Agents are born with zero assets and have different productivity due to their age. Households are endowed with 1 unit of labor. Labor will try to enter the formal sector if possible, since the wages are higher there and workers also received some other benefits,

such as fringe benefits. Still, the formal sector, either private or government, is not easy to access. The education and human relationship of workers play important roles in determining their ability to enter the formal sector. From the income they make, labor decides how much to consume, how much to save, and how much to transfer to the parents.

Agents live from age 1 to age 65. Here I assume that agents die at age 66, which follows Indonesian life expectancy. Their productivity characteristics are determined by age and experience. In determining the productivity characteristics of labor, I follow the method of Auerbach and Kotlikoff (1987).[1]

Preferences, Endowments, and Technology

The households have preferences over the homogeneous consumption good and leisure, given by the following:

$$(1) \qquad \sum_{t=0}^{65} \beta^j \left[u(c_{t+i}, l_{t+i}) \right]$$

The symbol β^j is the present value function of the utility function $u(.)$. The symbol *ct* and *lt* are consumption and leisure, respectively. The subscript *t* denotes the time period.

The OLG model comprises the working and retired generations endowed with initial assets ownership and one unit of time that they are able to allocate between work and leisure. The annual utility function of agents is given by the constant elasticity of substitution (CES) function:

[1] Another method in determining the labor productivity idiosyncratic is by applying the Markov calibration procedure to the labor data.

$$(2) \qquad u(c_t, l_t) = \left[c_t^{-\rho} + \frac{(1-\varepsilon)}{\varepsilon} l_t^{-\rho} \right]^{-\frac{1}{\rho}}$$

where ε is the time allocated for working, $\frac{(1-\varepsilon)}{\varepsilon}$ is the ratio of time between leisure and working (also represents the shadow price for leisure), c_t is consumption, and l_t is leisure. The symbol ρ is the elasticity of substitution between consumption and leisure.

The idiosyncratic labor productivity (Productivity Index) for Indonesia is given by the following function:

$$(3) \qquad PI(A) = Exp\left[8.4493 + 0.1128 * A - 0.0012 * A^2\right] / Exp(8.4493)$$

This productivity index follows the model of Auerbach and Kotlikoff (1987). The productivity index measures the productivity of labor according to age and wages. It is a linear combination between skilled and unskilled labor in the formal sector only. I assume that the productivity index is positively related to age A, but negatively related to the square of age A^2. This means that the production capacity of labor increases at the beginning, has its peak at a certain age (age 47), and after that goes down until the worker retires.

I estimate the productivity index for Indonesia by using raw labor age and wages data from 1998-2002. The data are taken in that time range as the dynamic CGE model starts from year 2000, so that the labor data fit the data around the year 2000. In addition, the amount of samples from five year intervals satisfies the minimum amount of samples to do the estimation. The estimation result is presented in Chapter Five.

There are two sectors in the economy, the formal and informal sectors, with two types of labor, skilled labor *Ls* and unskilled labor *Lu*. Both skilled labor and unskilled labor work in the formal sector, while only unskilled labor works in the informal sector.

It should be noted that, the year 2000 labor data (presented in Chapter Five) show that there is a small amount of skilled labor in the informal sector (0.5 percent of total labor). Because the amount is small, I ignore the role of the skilled labor in the informal sector.

According to Margono and Sharma (2004), the production function in Indonesia can be modeled according to the Cobb-Douglass production technology. The formal sector produces with the following Cobb-Douglas technology:

$$(4) \qquad Y_F = F(K_F, L_F) = Z_F \, K_F^{\alpha} L_{SF}^{\gamma} \, L_{UF}^{\omega}$$

Variable Y_F is the value added of the formal sector, and Z_F is the technology level of the production function in the formal sector. The symbol α is the elasticity of production of capital, γ is the elasticity of production of skilled labor, and θ is the elasticity of production of unskilled labor, with the sum of α, γ, and ω equal to 1.

The informal sector has a labor intensive technology with capital and unskilled labor:

$$(5) \qquad Y_I = F(K_I, L_I) = Z_I \, K_I^{\alpha} L_I^{\omega}$$

Variable Y_I is the value added of the informal sector, and A_I is the technology level of the production function in the informal sector. Equation (5) follows the Cobb-Douglas production function with a low value of α for the production elasticity of capital, as the informal sector production function is labor intensive. The sum of α and ω is equal to 1.

The Households Sector

The working generations in the formal sector have to choose their consumption c_t, the risk free assets holding a_t and the number of hours to work. The utility function follows a constant elasticity of substitution function.

The value function of skilled workers in the formal sector is:

$$(6) \qquad V_F(t,a.L) = \max_{c,a,l} \{u(c_t,l_t) + \phi\,[V(t+1,a_t,L]\}$$

Variable *t* (time) represents labor's age and variable *L* is the working hour of labor. The value of φ is between and inclusive 0 and 1. The state and control variable in the model is variable time *t*, variable asset a_t, and variable *L*.

The budget constraint of the agent is:

$$(7) \qquad (1+\tau^c)c_t + Tr + a_{t+1} \le a_t\left[1 + r(1-\tau^k)\right] + (1-\tau^w)\; w_F L_F + T_G$$

Variable τ^c is the consumption tax, τ^k is the tax on capital income and τ^w is the tax on labor income. Variable T_G is the transfer from government to households *Tr* is the income transfer from worker to parents. As I simulate the increase of consumption taxes, the consumption expenditures c_t becomes an important variable. I assume that skilled workers in the formal sector spend all their consumption expenditures on the goods produced in the formal sector only and pay consumption taxes. This assumption holds as informal sector goods are inferior relative to income due to low production quality. The higher the income is, the lesser the choice of consuming informal goods.

The value function of unskilled workers in the formal and informal sector is:

$$(8) \qquad V_I(t,a,L) = \max_{c,a,l} \{u(c_t,l_t) + \phi\,[V(t+1,\, a_t,L]\}$$

while the budget constraint of the agents is:

$$(9) \qquad (1+\tau^c)\,\theta c_t + (1-\theta)c_t + Tr + a_{t+1} \le a_t\,\left[1 + r(1-\tau^k)\right] + w_I L_I$$

Unskilled workers in the formal and informal sector do not pay labor taxes but pay capital income taxes because they could only put their assets in formal financial institutions. They neither receive the government pension benefits nor participate in the

employee's voluntary fully funded pension program. For unskilled workers in the informal sector, most of their wages are very low, lower than the wages of unskilled labor in the formal sector. Meanwhile, both type of workers still receive transfers from the government. In addition to differences in wages and wages taxes, the consumption expenditures of the workers in the informal sector are split into consumption expenditures on goods produced in the formal sector and goods produced in the informal sector. Parameter θ is a consumption expenditure coefficient with a value between and inclusive of 0 and 1. The workers pay consumption taxes when they consume goods produced in the formal sector but not when they consume goods produced in the informal sector.

The first order condition with respect to consumption for skilled labor households in the formal sector is given by:

$$(10) \qquad \frac{\partial V_F}{\partial C_t} = \left[c_t^{-\rho} + \frac{\varepsilon}{\lambda} l_t^{-\rho} \right]^{-\frac{1+\rho}{\rho}} c_t^{-(1+\rho)} - \phi(1+\tau^c)$$

The first order condition with respect to consumption for unskilled labor households in the formal and informal sectors is given by:

$$(11) \qquad \frac{\partial V_I}{\partial C_t} = \left[c_t^{-\rho} + \frac{\varepsilon}{\lambda} l_t^{-\rho} \right]^{-\frac{1+\rho}{\rho}} c_t^{-(1+\rho)} - \phi\theta(1+\tau^c) - \phi(1-\theta)$$

The first order condition with respect to leisure for the three types of households is given by:

$$(12) \qquad \frac{\partial V_{F,I}}{\partial l_t} = \left[c_t^{-\rho} + \frac{(1-\varepsilon)}{\varepsilon} l_t^{-\rho} \right]^{-\frac{1+\rho}{\rho}} \frac{(1-\varepsilon)}{\varepsilon} l_t^{-(1+\rho)}$$

Readers can see that, while the first order condition with respect to leisure is the same for all types of households, the first order condition with respect of consumption is different.

These differences will imply different choices of optimal consumption and leisure, respectively.

The movement of labor from the formal sector to the informal sector, or the other way around, takes place as they maximize their value function $V(t, a, L)$:

$$(13) \qquad V(t,a,L) = \max \left\{ V_F(t,a,L), V_I(t,a,L) \right\}$$

Labor will stay in the formal sector if $V_F(.) \geq V_I(.)$. They will stay in the informal sector if $V_F(.) < V_I(.)$.

The last agents in the households are the retired agents. They retire at age 55, and for simplicity they are assumed to die at age 65. For unskilled labor, either from the formal sector or the informal sector, most of the retirees need to work to support themselves. They have difficulties generating savings while they are young, since their income is only sufficient for the consumption of the family. For skilled labor, there are transitions of labor from the government sector and from the private sector after the agents retired. McKee (2006) stated that around 50 percent of government employees move into either the private sector or self-employment after they retire, while around 61 percent of private sector workers move into self-employment after they retire. Self-employment for labor falls in the area of informal sector. Given such conditions, the value function for the retired population in Indonesia is:

$$(14) \qquad V^R(t,a,S,L) = \max_{c,a,l} \left\{ u(c_t, l_t) + \phi \left[V(t+1, a_t, S_t, L \right] \right\}$$

with a budget constraint defined as :

$$(15) \qquad (1+\tau^c)\theta c_t + (1-\theta) c_t \leq a\left[1 + r(1-\tau^k)\right] + w_I L_I + P + S$$

Variable P is the pension benefit they receive from the government (e.g., the redistribution benefit), and variable S is their own savings or the fully funded pension of

their own. The first order conditions for consumption and leisure of the retired population are the same as in equations (11) and (12), respectively.

The Firm Sectors

The single representative firm in the formal sector maximizes the following profit function:

$$(16)\ \max_{K,L} \Pi_F(w_F, r) = (1-\tau_F)F(K,L) - (1-\tau_w)ws_F Ls_F - wu_F Lu_F - (r_F + \delta_F)K_F - p_m M$$

where δ is the depreciation rate of capital, *r* the interest rate, τ_F is the corporate income tax, and τ_w is the skilled labor income tax. Variable p_m is the price of imported production material, variable *M* is the imported amount of production material. The unskilled labor income is usually below the taxable amount of labor income. The first order conditions with respect to capital, skilled labor, and unskilled labor give, respectively:

$$(17)\qquad F_1'(K^F, L^F) = \frac{(r_F + \delta_F)}{1-\tau_F}$$

$$(18)\qquad F_2'(K^F, L^F) = \frac{(1-t_w)ws_F}{1-\tau_F}$$

$$(19)\qquad F_3'(K^F, L^F) = \frac{wu_F}{1-\tau_F}$$

The representative firm in the informal sector maximizes the following profit function:

$$(20)\qquad \max_{L} \Pi_I(w_I, r_I) = F(K^I, L^I) - (r_I + \delta_I)K_I - wu_I Lu_I$$

I assume that the capital is not accumulated in the long run production function in the informal sector. The first order condition for the firm in the informal sector with respect to capital is given by:

(21) $F_1'(K^I, L^I) = r_I + \delta_I$

Note that the interest rate and depreciation rate in the informal sector are different from the ones in the formal sector. The informal sector interest rate r_I is higher than the formal sector interest rate r_F due to lending risk in the informal sector, such as weak lending contract. The formal and informal capital markets are weakly separated. The capital in the formal production sector comes from the formal capital market, while the capital in the informal production sector comes from the informal capital market. However, the capital might move from the formal capital market to informal capital market.

The first order condition for the representative firm in the informal sector with respect to unskilled labor is:

(22) $F_2'(K^I, L^I) = w_I$

For simplification, a penalty for a formal firm wittingly operating in the informal sector is not included because law enforcement in Indonesia is weak.

I also allow the movement of firms from the formal sector to informal sector, or the other way around. The movement of firms between sectors is a function of profit maximization $\Pi(w, r)$:

(23) $\Pi(w,r) = \max\{\Pi_F(w,r),\ \Pi_I(w,r)\}$

Firms with small to medium size have incentives to move between sectors. They will stay in the formal sector as long as $\Pi_F(.) > \Pi_I(.)$, and will stay in the informal sector if $\Pi_F(.) < \Pi_I(.)$.

The Pension Sector

There are two running pension systems in Indonesia right now. The first type is the first pillar defined benefit system, but not the pure pay-as-you-go type, as the benefit is set by the government without any contribution from employees, since the government fully subsidizes the program (Simanjuntak, 2003). The fund for the subsidy is collected from central government tax revenue. This type of pension holds only for the civil servant and the military. The second type is the third pillar voluntary fully funded defined contribution. Rachmatawarta (2004) stated that there are not many employees involved in this program. Information regarding the participation rate is unavailable.

In the simulations related to the first research question, the first pillar defined benefit type is financed by the consumption tax for cash transfers for all pensioners. Because the cash transfer program is more general and covers all type of workers, the plan is expected to replace the current defined benefit plan for the civil servants. The second pillar is a fully funded defined contribution savings plan for workers whose level of income is sufficient to follow the program.

The households' total contribution consumption tax for the first pillar defined benefit is defined as:

$$(24) \qquad P_t = \begin{Bmatrix} \tau^c C_t & \text{for skilled labor at formal sector households} \\ \tau^c \theta C_t & \text{for unskilled labor at formal and informal sector households} \end{Bmatrix}$$

Again, the variable τ^c is the consumption tax, the variable θ is the fraction of consumption of formal sector goods, and the variable Ct is the households' aggregate consumption expenditure. Note that even though the contribution is different among

households, the benefit for any type of household would be the same as it is a lump-sum benefit.

Meanwhile, the fully funded savings program is defined as:

$$(25) \qquad S = \sum_{t=1}^{Y} (1+r)^{Y-t} H_t = \sum_{t=1}^{T} \frac{1}{(1+r)^t} B_t$$

The pension savings *S* equals the total annuities of fully funded savings contribution during work life H_t , which equals the present value of benefit *Bt* received when individuals retire.

The Government Sector

The central government receives taxes from consumption taxes. For Indonesia, the value added tax is the largest source of revenue of consumption taxes (27 percent of year 2000 central government revenue), followed by sales taxes (8.6 percent of year 2000 central government revenue). In addition to consumption taxes, capital income taxes in 2000 shared 34 percent of the total disposable capital income. Meanwhile, the tax on labor is very small, only 1.8 percent of the total disposable labor income. This demonstrates that the central government is incapable of collecting taxes on labor income.

Given these conditions, the modeling for the government revenue and expenditure is:

$$(26) \qquad D(t) = \sum_{t=0}^{\infty} \frac{1}{(1+r)^t} \left[(G + T_G + P_t) - (\sum_{i=1}^{n} \tau^c c_t + \sum_{i=1}^{n} \tau^k r\, a + \sum_{i=1}^{n} \tau^w w_F + \tau^F Y_F) \right]$$

Variable *D*(t) is the government deficit, variable *G* is the government expenditure, and variable T_G is the government transfer to households. The transfer is in terms of consumption. The government deficit is financed by increasing the consumption tax, and

so is equal to zero in each period; that is, in the simulation, the consumption tax balances the government budget. The Indonesian government bond market has just been developed in 2005, and so it is not modeled here.

The Foreign Sector

The Indonesian economy imports consumption goods and investment goods from abroad. The foreign good is assumed to be a perfect substitute for the domestic commodity. Labor is the only non-traded good.

The trade balance *TB* is defined as:

$$(27) \qquad TB_t = Y_t - C_t - I_t - G_t$$

Meanwhile, the foreign debt B_t^e is connected to the net exports TB through this relation:

$$(28) \qquad B_t^e = \sum_{\tau=t}^{\infty} R_t^g \; TB_t$$

where R_t^g is the trade balance discount factor.

The Competitive Equilibrium

The equilibrium for the economy assumes the following conditions.

The total labor in the economy is comprised of skilled labor in the formal sector Ls_F, unskilled labor in the formal sector Lu_F, and unskilled labor in the informal sector Lu_I.

$$(29) \qquad L = Ls_F + Lu_F + Lu_I$$

The total capital in the economy is the sum of capital in the formal sector K_F and the informal sector K_I, or:

(30) $K = K_F + K_I$

The initial capital amount for production in the formal production sector is the initial capital income divided by interest rate and depreciation rate:

(31) $K_0 = \frac{1}{r_F + \delta_F} R_0$

Aggregate investment I in the formal sector is defined as an increment to the capital stock *Kt*, or

(32) $K_{t+1} = I_t + (1-\delta)K_t$

(Recall that capital does not accumulate in the informal sector.) Meanwhile, the clearing price of capital in both markets is:

(33) $r_I = r_F + \Gamma$

where Γ is the lending risk in the informal sector.

The next equations are the marginal conditions for prices in the formal sector. First is the interest rate in the formal sector:

(34) $r_F = (1-\tau^F)\alpha Z_F K_F^{\alpha-1} L_{sF}^{\gamma} L_{uF}^{\omega} - \delta_F$

so that the interest rate, as the price of capital, satisfies the marginal condition for capital in the formal sector. (Recall that the interest rate in the informal sector is derived from this via equation (33).) The wage of skilled labor in the formal sector is given by:

(35) $w_s^F = \frac{(1-\tau^F)}{1-t_w} \gamma Z_F K_F^{\alpha} L_{sF}^{\gamma-1} L_{uF}^{\omega}$

so that the wage of skilled labor in the formal sector satisfies the marginal condition for labor in the formal sector, as does unskilled labor in the formal sector according to.

(36) $w_u^F = (1-\tau^F)\omega Z_F K_F^{\alpha} L_{sF}^{\gamma} L_{uF}^{\omega-1}$

Meanwhile, the marginal condition for prices in the informal sector is given as

(37) $$r_I = \alpha Z_I K_I^{\alpha-1} L_{uI}^{\omega} - \delta_I$$

so that the interest rate, as the price of capital, satisfies the marginal condition for capital in the informal sector. Finally,

(38) $$w_u^I = \omega Z_I K_I^{\alpha} L_{uI}^{\omega-1}$$

so that the wage of labor in the informal sector satisfies the marginal condition for labor in the informal sector.

The macroeconomy equilibrium satisfies the fact that Indonesia is a small open economy country:

(39) $$Y = C + I + G + X - M$$

Finally, to satisfy the small open economy assumption, the domestic interest rate *r* adjusts to the international interest rate r_e in the long run, so that:

(40) $$r = r_e$$

Examples of the small open economy dynamic CGE model can be seen at Broer and Westerhout (1997), and Broer, Westerhout, and Bovenberg (1994).

The Market Clearing Condition

As there are movements of labor between sectors, we may conclude that there is a market clearing price of labor that adjusts the amount of labor in the two markets. From equations (33) and (35), we can define the price of unskilled labor w_u^F in the formal market as:

(41) $$w_u^F = \frac{\omega_F}{\alpha_F}(r_F + \delta_F)\frac{K_F}{L_{UF}}$$

From equations (34) and (35), we can define the price of skilled labor w_S^F in the formal market:

$$(42) \qquad w_S^F = \frac{\gamma_F}{\alpha_F} \frac{(r_F + \delta_F)}{\left(1 - t^w\right)} \frac{K_F}{L_{UF}}$$

From equations (33) and (34), the optimal amount of skilled and unskilled labor in the formal sector is given as:

$$(43) \qquad \frac{w_S^F}{w_u^F} = \frac{\gamma}{\omega} \frac{1}{(1 - t^w)} \frac{L_{UF}}{L_{SF}}$$

Finally, from equations (36) and (37), we can define the price of unskilled labor in the informal sector:

$$(44) \qquad w_u^I = \frac{\omega_I}{\alpha_I} (r_I + \delta_I) \frac{K_I}{L_{UI}}$$

Given the market clearing condition for the unskilled labor in both sectors:

$$(45) \qquad w_U^F = w_U^I$$

we can write the optimal amount of unskilled labor in both sectors:

$$(46) \qquad \frac{L_{UF}}{L_{UI}} = \frac{\alpha_I \omega_F}{\alpha_F \omega_I} \frac{(r_F + \delta_F)}{(r_I + \delta_I)} \frac{K_F}{K_I}$$

What can we infer from the market clearing condition? First, from equation (43), there is always a certain ratio between the amount of skilled and unskilled labor in the formal sector. Second, from equation (46), the ratio of unskilled labor in both sectors is the function of the ratio of capital in both sectors. The implication is that taxing capital in the formal sector would induce the movement of capital to the informal sector, and also would alter the ratio of unskilled labor in both sectors.

The Simulation

After the calibration of the model above, there are two simulations that are done. The first simulation is the increase of consumption taxes as a source of finance for a defined benefit pension program for retirees. The purpose of this program is to provide a minimum physical need for all pensioners. The second simulation is the extension of a mandatory fully funded system that links the contribution and the benefit, thereby serving as the savings purpose of the pension program. The purpose of the two simulations is to look at the impact of taxation on the amount of labor in the both the formal and informal sectors, and the possibility of the extension of the formal sector through the extension of the fully funded pension program. As labor is able to move from the formal sector to the informal sector and vice versa, the consumption taxes may at some rate drive the movement of labor from the informal sector to the formal one, as the taxation changes the value function of consumption, leisure, and income.

For the first simulation with the defined benefit program, I choose the tax on consumption since there is no link between the benefit received and the amount of tax paid. This is one way to cut the link between the benefit received and the amount of tax paid that exists in the payroll taxes. Theoretically, for a defined benefit program, the government should not charge a pension tax from employers, as this increases the burden on enterprises in term of an increase in the cost of production, or it induces employers either to move to the informal sector or to cut-off the amount of hired employees, as happened in Brazil (Filho, 2005), China (Yuan and Feng, 2004), and Turkey (Brook and

Whitehouse, 2006).[2] The government also should not charge the tax on wages of the formal workers to finance the first pillar mandatory defined benefit pension plan, as this induces workers to move to the informal sector. This also happened in Brazil.

Another theoretical reason for choosing the consumption tax: it is the only tax variable that does not link to the tax of capital and labor, as shown in equation (25) on the government revenue. The tax on capital reduces the usage of capital; the tax on labor income reduces the labor supply, while the tax on corporate income reduces both labor and capital. All of the three taxes, on capital, on labor, and on corporate income, mostly take place in the formal sector. Therefore, increasing one of the taxes creates an incentive for labor and firms to move to informal sector. The tax on consumption holds generally for labor in the formal and informal sector so that there is little incentive for intersectoral movement, as long as the tax rate is bearable for taxpayers. Valverde (2006) also suggests the use of consumption tax financing for pension plans in countries with a large informal labor market.

The second simulation is the implementation of a mandatory fully funded pension program. In the simulation, even though the program holds for the total workers in the formal sector, both skilled and unskilled, I assume that not many unskilled laborers follow the program as their labor income is not sufficient if they have to pay the fully funded program on their own. The rate of participation is set at 10 percent of the wages of skilled labor. The justification for the 10 percent rate is that Law No. 11/1969 regarding the pension for civil servants stated that the contribution from employees is 4.75 percent.

[2] For information, Turkey is a member of OECD countries who runs a three-party pension system with formal and informal production and labor markets.

I round up the contribution to 5 percent, and assume that the government or the employers match another 5 percent of contribution.

CHAPTER FIVE

The Program and Data

This chapter elaborates on the computer program used to solve the OLG-CGE model and the data used to solve the model. The organization of this chapter is as follows. I first discuss the computer program used to find solutions for the OLG-CGE model. After that, I discuss the data used for the model. There are three important classifications of data. The first is macroeconomy data, the second is microeconomic data on consumption, leisure, and interest rates, and the third category is data on population and labor markets, including the productivity of labor. Data in all classes are related to Indonesia, unless specified as US data for the purpose of comparison.

The Program

To understand how data are chosen, it is important first to understand how the program works. The program for overlapping generation computable general equilibrium (OLG-CGE) model follows the one written by Auerbach and Kotlikoff (1987). Before the year 2001, this program was written in the FORTRAN computer language. Starting in the year 2001, through the generosity of Professor Thomas Rutherford (Rasmussen and Rutherford, 2004), scholars who work on OLG modeling are able to write the program in GAMS language.[3]

[3] Having written the mathematical OLG model in paper term, I corresponded by e-mail with Professor Laurence J. Kotlikoff from Boston University and Professor De Peter Broer from Tilburg University, Netherlands, at the end of year 2005. Each person stated that they still write the OLG model in FORTRAN computer language. Rasmussen and Rutherford (2004) state that their paper is the first "how to" introduction to overlapping generations modeling. In the paper, they use GAMS instead of FORTRAN. I

The OLG-CGE model is a standard theoretical mathematical model (e.g., CES intertemporal utility function between consumption and leisure, the theorem of steady-state, the Keynesian aggregate saving-investment balance). Transferring the model from paper to computer does not much change the language. The syntax program for the OLG model in the computer is also a theoretical mathematical one. One of the characteristics of the theoretical model is its generality, valid for every economic structure. The implication is that, applying the model from one economy to another needs only change the data without changing the program, assuming the programmer has the same purpose for the model application.

There are three types of basic OLG-CGE modeling. The first and the simplest one is the OLG Exchange model. A second and more complex one is the OLG Bequest model. The third type of model, and the one that I apply here, is the OLG Production model. The three OLG models could be mixed one into another according to necessity. For elaboration of each model, see Rasmussen and Rutherford (2004).

The fundamental of the mathematical OLG program is the intertemporal macroeconomy model. In the model, the variables consumption, leisure, and interest rates play an essential role. Consumption and leisure generate the intertemporal utility function of the individuals in the model. The interest rate functions as the relative price of present and future consumption. Since the OLG model is a dynamic one, there is also the variable time in the model. Time is set annually and separated into consumption and leisure. In addition, variable assets are included as an exchange for consumption before

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myself find that writing the OLG-CGE model in GAMS program is much more user friendly than writing it in FORTRAN.

the individual is working, and therefore one is able to consume from the beginning of one's time at age 21, after one's retirement at age 55, and to the end of time at age 65.

The basic OLG production model has five steps in the construction of model blocks. The first step is the set building for generation indexes, time periods, and life-cycle. The second step consists of the construction of the benchmark steady-state of reference generation. The replication of the second step for every generation by mapping each variable to every generation follows in the third step. After that, the redistribution of assets as a benchmark of assets holding is completed in the fourth step. Finally, the fifth step consists of the building of the macroeconomy block. A calibration procedure is processed after each step is completed. The GAMS program applies the Newton iteration method for calibration.

Data for the Production Model

The starting point for the development of any CGE model, either static or dynamic, is the construction of a macroeconomic but microeconomic-consistent benchmark data set. Since the pioneering work of Pyatt and Thorbecke, the benchmark dataset for a CGE model is specified in the form of social accounting matrix (Davies, 2004).

Data for the OLG-CGE Production model comprise benchmark macroeconomy data, the population set, fundamental parameters, the productivity index, and a labor condition. Below is the elaboration for each category. All data are set starting from year 2000 because this is the year for the latest data released of the Indonesia social accounting matrix. I also set year 2000 as the benchmark time for all benchmark data

collected. The consequence is the initial steady-state condition in the model starts from the year 2000.

The Benchmark Macroeconomy Data

The Indonesian open macroeconomy data for year 2000 can be seen at Table 6.

Table 6. Indonesia: The Summary of Year 2000 Macroeconomy Outlook (Trillion Rupiah)

	Output	Income			Expenditure				Total
	1	2	3	4	5	6	7	8	
1					937.5	233.7	115.7	569.5	**1,856.4**
2	725.9								**725.9**
3	642.2								**642.2**
4		184.2	11.3						**195.5**
5		541.7	630.9				72.6		**1,245.2**
6					307.7		7.2	(81.2)	**233.7**
7				195.5					**195.5**
8	488.3								**488.3**
Total	**1,856.4**	**725.9**	**642.2**	**195.5**	**1,245.2**	**233.7**	**195.5**	**488.3**	***5,582.7***

Notes: 1 = Output, 2 = Value Added on Capital, 3 = Value Added on Labor, 4 = Tax Revenue, 5 = Private Consumption, 6 = Investment, 7 = Government Expenditure, 8 = Rest of the World
Source: "Sistem Neraca Sosial Ekonomi Indonesia 2000" (2003), modified by Widjaja.

Here are the lists of benchmark macroeconomy data for Indonesian economy, taken from the macroeconomy data in Table 5.1. The matrix itself is the summary of Indonesian year 2000 social accounting matrix.[4] Later on, the figures will be replicated and developed in the CGE model through generations. Figures are in year 2000 rupiah trillion, except for the benchmark tax rates.

C0	benchmark private consumption	937.5
I0	benchmark investment	233.7
G0	benchmark government consumption	115.7
X0	benchmark exports	569.5

[4] The actual Y2000 Indonesia social accounting matrix comprises of three size categories. The largest one is 110 rows * 110 columns. The medium size is 38 rows * 38 columns. The smallest one is 13 rows * 13 columns. The matrix in this paper is summarized from the smallest social accounting matrix.

M0	benchmark imports	488.3
R0	benchmark capital earnings (net of tax)	541.7
L0	benchmark labor earning (net of tax)	630.9
S0	benchmark savings	307.7
T0	benchmark government transfers to households	72.6
D0	benchmark government budget deficit	- 7.2
B0	benchmark trade deficit	- 81.2
Y0	benchmark output	1,368.1
K0	benchmark capital stock	864.0
TR0	benchmark tax rate on capital income	0.34
TL0	benchmark tax rate on labor income	0.018

Benchmark output Y0, Rp.1,368.1 trillion, is the sum of value added on capital (Rp. 725.9 trillion) and value added on labor (Rp. 642.2 trillion). The figure is then broken down into the tax on capital (Rp. 184.2 trillion), the benchmark capital earnings R0 (Rp. 541,7 trillion), the tax on labor (Rp. 11.3 trillion), and the benchmark labor earnings L0 (Rp. 630.9 trillion).

The sum of the tax on capital and the tax on labor equals the government tax revenue (Rp. 195.5 trillion). This figure, after distributed into government consumption G0 (Rp. 115.7 trillion) and government transfers T0 (Rp. 72.6 trillion), becomes government budget surplus or negative government deficit D0 (Rp. 7.2 trillion).

The benchmark government consumption G0 (Rp. 115.7 trillion) is the sum of government expenditures, and consists of four items. Those items are intra-government transfers, government expenditure on domestic goods, government expenditure on imported goods, and interest payments on foreign loan (not shown in the matrix).

The benchmark private consumption C0 (Rp. 937.5 trillion) is the total household expenditures, comprising four items: transfers among households, household expenditure on domestic goods, household expenditure on imported goods, and household transfers abroad (not shown in the matrix).

The counterpart of the benchmark consumption is the benchmark savings S0 (Rp. 307.7 trillion), which is the sum of take home labor earnings (Rp. 541.7 trillion), take home capital earnings (Rp. 630.9 trillion), and government transfers to households T0 (Rp. 72.6 trillion), subtracted by benchmark private consumption C0 (Rp. 937.5 trillion).

For the open economy data, the benchmark trade deficit B0 is negative, or Rp. 81.2 trillion in year 2000, as the value of exports X0 (Rp. 569.5 trillion) is larger than imports M0 (Rp. 488.3 trillion). Indonesia experienced a surplus in its current account in that year.

For domestic data, benchmark investment I0 (Rp. 214.1 trillion) is equal to the sum of benchmark savings S0 and the government budget deficit D0. Links among the three variables satisfy the savings-investment balance relationship.

Another important variable is the benchmark capital stock K0. For a developing country like Indonesia, some economic data do not exist. The data on the capital stock is no exception. Some researchers from the Bank of Indonesia, the Indonesian Central Bank, have tried to estimate the capital stock for Indonesia. Wicaksono, Ariantoro, and Sari (2002) estimated the capital stock of Indonesia by using a perpetual inventory method and comparing the gross estimation result with the net one. The result of their simulation is in Table 7.

Table 7. Indonesia: The Estimation of the Capital Stock (Year 2000, Trillion Rupiah)

Gross Capital Stock	Net Capital Stock	
	Australian Method (Discard Function)	Netherlands Method (Survival Function)
1,939.8	1,236.5	1,336.9

Source: Wicaksono, Ariantoro, and Sari (2002)

Still, the estimation result in Table 7 is under debate.[5]

I follow the Auerbach and Kotlikoff calculation method. Their calculation method is that the benchmark capital stock K0 is equal to the ratio of benchmark capital earnings divided by the sum of the periodic interest rate and the periodic depreciation rate. The result for K0 is Rp. 864 trillion.

Still following Auerbach and Kotlikoff, the data for the benchmark tax rate on capital income TR0 is set from the tax effort data (e.g., the ratio of tax revenue over the tax base) on capital. The figure reached as high as 34 percent (or 184.2/541.7) in year 2000. Similarly, the benchmark tax rate on labor income TL0 is the tax effort on labor, and is low, only 1.8 percent. These calculations show that there is a lot more effort to be done to increase the tax revenue from labor income, including the pension tax. At the end of Chapter Five, I elaborate benchmark labor data, to get a better picture for why the tax effort on labor income in Indonesia is so low.

The Population Set

The population set comprises time interval, life cycle, and generation. The time interval is set at a 5-year cycle for each period in order to catch the long run impact of pension policy without having too many unimportant details. Again, year 0 in the model is year 2000. The "existence" of people in the model begins at age 21 where people enter the labor market. According to the United Nations Development Programme (UNDP), the life expectancy for Indonesia reached age 65.6 in year 2000. Therefore, in order to construct the model close to the factual, the life cycle is set from 0 to 40, meaning that

[5] There is also a work in progress by Van der Eng (n.d.) from Australia National University on the estimation of the Indonesia capital stock. Unfortunately, the Van der Eng requested that the paper not be quoted, as it is not finished yet.

people "die" at age 65. The calculation of the maximum age in the model is the initial age (20) plus the maximum amount of age point in the life-cycle (9) multiplied by the time interval (5). Currently, pensions for civil servants start at age 56 in Indonesia. The time period is set from year 0 to year 120.

Generation is set from the initial year for the oldest generation born at age (-40), to the end of the observed time period at time 120. Therefore, there are four generations in the model, starting from time (-40) to time 0, from time 0 to time 40, from time 40 to time 80, and from time 80 to time 120.

The Fundamental Parameters[6]

There are eight required fundamental parameters, and the way each datum is collected is different one from another. The data comprise the annual interest rate, the annual population growth rate, the annual depreciation rate, the intertemporal elasticity, the elasticity of substitution between consumption versus leisure, the consumption share parameters, the elasticity of transformation between domestic goods versus exports, and the Armington elasticity. The next paragraphs discuss how these parameters are chosen.

Annual interest rate. The annual real interest rate is calculated at 7 percent for Indonesia. The value is 5 percent for US case. The formula for the real interest rate is

$$(30) \qquad r_a = (1-\tau)\, i - \pi_c$$

where r_a = real interest rate

τ = consumption tax rate, set at 10 percent

[6] Fundamental parameters are required parameters in order for the OLG-CGE simultaneous equation system to work well. See Rasmussen and Rutherford (2004) for more information.

i = nominal interest rate for consumption credit (20 percent in Y 2000)

π_c = inflation rate at the food sector (11 percent in Y 2000).

Source: "Indonesian Financial Statistics" (various)

The annual interest rate is developed as the periodic interest rate by the following formula:

$$(31) \qquad r = (1+ r_a)^{T} - 1$$

where r = periodic interest rate

T = time interval.

Population growth rate. Data for the Indonesian annual population growth rate is taken from the United Nations population projection. The year 2000 annual population growth rate is 1.26 percent. See Table 8.

Table 8. Indonesia: The Annual Periodic Population Growth Rate (percent)

2000-2005	2005-2010	2010-2015	2015-2020	2020-2025
1.37	1.30	1.21	1.09	0.94

Source: *Population projection 2000-2050*

I calculate the periodic population growth rate γ by the following formula:

$$(32) \qquad \gamma = (1+ 0.01)^{T} - 1$$

Rasmussen and Rutherford set the US annual population growth rate at 1 percent. They do not set the aging phenomenon into the model.

Annual depreciation rate. The macroeconomy data for the annual depreciation rate of capital are shown in Table 9, where I present the Indonesian macroeconomy annual depreciation rate.

Table 9. Indonesia: The Annual Macroeconomy Depreciation Rate

Year	(a) Depreciation (Current Prices, Trillion Rp)	(b) GDP (Current Prices, Trillion Rp)	(a/b) Average Depreciation Rate (percent)
1990	9.8	195. 6	5.0
1991	11.4	227. 4	5.0
1992	13. 0	259. 9	5.0
1993	16. 5	329. 8	5.0
1994	19. 1	382. 2	5.0
1995	22. 7	454. 5	5.0
1996	26. 6	532. 6	5.0
1997	31. 4	627. 7	5.0
1998	47. 8	955. 7	5.0
1999	55. 0	1 099. 7	5.0
2000	63. 2	1 264. 9	5.0
2001	73. 4	1 467. 6	5.0
2002	80. 9	1 619. 1	5.0

Source: "Statistik Enam Puluh Tahun Indonesia Merdeka"

These data are calculated as a comparison for the annual depreciation rate of capital in the model. The actual annual depreciation rate for Indonesia is 5 percent on average. Given the (initial) steady state condition[7]

$$\frac{R}{I} = \frac{r+\delta}{\gamma+\delta} \qquad (33)$$

together with the assumptions that $r = 0.07$, $\gamma = 0.01$, $\delta = 0.05$, the benchmark macroeconomy data above, the ratio of the after-tax capital earning R to investment level I equal to 2.0, then in order to fit the steady-state condition, the actual value of investment level I must be modified. This annual depreciation rate itself is then developed into periodic depreciation rate by the following formula:

$$\delta = 1 - (1- \delta_a)^{T} \qquad (34)$$

[7] Please see Rasmussen and Rutherford (2004) for derivation of the formula

where $\delta_{a,}$and δ is the annual and periodic depreciation rates, respectively.

For the US case, Rasmussen and Rutherford set first the value of r, γ, and δ. The value of δ was set at 7 percent. After that, they modified the value of investment *I* to fit the steady-state condition.

Inverse intertemporal elasticity. There are no available data for the Indonesia inverse inter-temporal elasticity. I try to find the value by doing some econometric estimation, following the work of Mankiw (1985) for US data. Auerbach and Kotlikoff put the values of the intertemporal elasticity estimated from the work of Mankiw. The figure ranges from -0.23 to -0.37. They chose 0.25 as the intertemporal elasticity value, with an implied inverse of 4.

My econometric work used the OLS method, and finds the value of alpha, the inter-temporal elasticity as -0.1881 (Table 10). This means that the inverse inter-temporal elasticity (1/alpha) for Indonesia reached 5.3 for the upper benchmark figure. The OLS model specification is shown in Table 10.

Table 10. Indonesia: The OLS Estimation of Intertemporal Elasticity

Year 1983-2004

$$\log\left(C_{t+1}/C_t\right) = a_0 + 1/\alpha \log(R_{C,t+1}) + \eta_{C,t+1} \quad (35)$$

where:

$\log\left(C_{t+1}/C_t\right)$ = the growth rate of annual consumption

$R_C = 1 + (1-\tau)i - \pi_C$ = one plus the after-tax real interest rate measured in terms of non-durable goods, which is the relative price of consumption today versus consumption tomorrow.

	Coeficient	t-stat	Prob-t
a_0	0.4365	6.685	0.000
$1/\alpha$	-0.1881	-5.763	0.000
F(1, 20) = 33.21		R-squared = 0.6241	
Prob > F = 0.0000		Adj R-squared = 0.6053	

Source : Widjaja's STATA estimation

The model equation is actually the Euler condition of the relative price of the current and future consumption, derived from the log utility of intertemporal consumption function Mankiw (1985). The relative price is the after tax real interest rate. The data for the annual growth rate of consumption are calculated from the annual data of macroeconomy aggregate consumption, issued by the Central Board of Statistics, while the data for the interest rate are the ones issued by Bank Indonesia.

The estimation result shows an R-squared 0.6241, meaning that the model does not perfectly explain the movement of inter-temporal consumption function. Still, the estimation of the explanatory variables shows a good result. The t-statistic for 1/α is -5.763 with probability 0.000, which suggests that the after tax real interest rate as a relative price is a good explanatory variable. Starting from the upper benchmark value 5.3, I put the value one by one (5.3, 5.2, 5.1, 5.0, 4.9, etc.), and get the optimal value for Indonesia at 4.0.

Elasticity of substitution. The elasticity of substitution (σ) between consumption versus leisure ranges from 0.1 to 1. The value for the US case is chosen at 0.8. The elasticity is useful to find the CES power between consumption function and leisure (ρ). I put the values into the model one by one (0.8, 0.7, 0.6, etc.), and find that 0.4 is the optimal value

for the Indonesia elasticity of substitution. The relationship between the two variables is defined as:

$$(36) \qquad \rho = 1 - 1/\sigma$$

Consumption share parameter. Auerbach and Kotlikoff set the value 0.4 for the US consumption share parameter. They assumed that people work 2000 hours a year (40 hours per week) from 5000 hours available per year. It is assumed that the income from total working hours multiplied by wages equal consumption. For the case of Indonesia, I chose the consumption share parameter around the value of 0.4.

Elasticity of transformation. The elasticity of transformation of resources between domestic versus exports is taken from the work of Robinson, Said, and San (1997). By using a static CGE model, they try to observe the impact of the economic crisis on the Indonesian rice market. They calculated that for the case of Indonesia, the elasticity of transformation ranges from 0.5 to 2.0, depending on the economic sector. I set the figure at 1.2 from the value of the agricultural sector elasticity of transformation that dominates the Indonesian economy. For the US case, the value is chosen at 4.0.

Armington elasticity. The Armington elasticity parameter measures the effect of the changes of landed (tariff inclusive) prices of imported goods on the price of the same domestically produced goods (Warr, forthcoming). Leith, Porter, and Warr (2003), by using a static CGE model in the work on Indonesian rice commodity and tariff, estimated that the Armington elasticity on imports for Indonesia ranges from 2.0 to 10.0. I choose

the lowest figure since that is the value that fits the Indonesian model. For the US case, the chosen value is 4.0.

The Benchmark Labor Data

The labor data are taken from the Statistics of Labor Force in Indonesia, published by the Indonesian Central Board of Statistics. The summary for Indonesia labor force condition is presented in Table 11. In total, there are 90.79 million people in the Indonesian labor force. This amount is around 44 percent of the total Indonesian population in year 2000 (205.8 million people).

Table 11. Indonesia: The Composition of Labor Force (Year 2000, Million People)

		Skilled	Unskilled	Total
Formal	**Absolute**	3.46	28.21	31.67
	(Percent)	(3.9)	(31.1)	(35.0)
Informal	**Absolute**	0.52	58.60	59.12
	(Percent)	(0.5)	(64.5)	(65.0)
Total	**Absolute**	3.98	86.81	90.79
	(Percent)	(4.4)	(95.6)	(100)

Source: "Laborer/Employees Situation in Indonesia" (various)

The composition of the Indonesian labor force is as follows: there are 3.98 million people of skilled labor (4.4 percent of total labor in Indonesia) and 86.81 million people of unskilled labor (95.6 percent of total labor). I define skilled labor as people in the working force who finished their college and university education. Unskilled labor is

defined as people in the working force who finished only their high school education or lower.

Most of skilled labor is able to work in the formal sector, or 3.46 million people. In total there are 31.67 million people in the formal sector, or 35 percent of total labor. The other 65.0 percent or 59.12 million people work in the informal sector. I define formal production sector as employers who employ paid labor and employees who work as paid labor. Informal production sector is defined as the self-employed, as employers who employ unpaid labor, and as employees who work as unpaid labor. The definition of paid and unpaid is whether there exists a contract between employers and employees. Table 11 also indicates that there are 0.52 million people of skilled labor in the informal sector. In the model construction in Chapter Four, I ignore the role of skilled labor in the informal sector because the portion is small, only 0.5 percent of total Indonesian labor.

From the Book of Year 2000 Indonesia Social Accounting Matrix, the average amount of wages and salary reached Rp 9.9 million in the formal sector and Rp. 4.6 million in the informal sector. From that information, I calculate the ratio of wages and salary between formal and informal sector as 2.2:1. In terms of the time efficiency amount, the average labor wages and salary in year 2000 reached Rp. 8.9 million in the formal sector and Rp. 4.9 million in the informal sector. The ratio between the two was 1.8:1. However, from the calibration result, the ratio between the two cannot be inferred since the results for both prices of labor start from 100 percent and then decline at the same rate.[8]

[8] This is an example of one of the features of using the CGE model. The model is very rigid in the presentation of results and the growth of variables, following the parameter set-up in the model.

In Table 12, I do an econometric estimation to observe the relation between skilled labor and government expenditure, following the work of Verbina and Cowdhury (2002). It is assume that the annual amount of college and university students is a function of the population, the income of the family (measured here by GDP per capita), and the government education expenditure.

Table 12. Indonesia: The OLS Estimation of Elasticity of Government Education Expenditure to Skilled Labor Creation 1983-2004

$$\ln y_t = \beta_1 \ln x_{1t} + \beta_2 \ln x_{2t} + \beta_3 \ln x_{3t} + \varepsilon_t \quad (37)$$

where:
$\ln y_t$ = the logarithm of the annual amount of college and university student
$\ln x_{1t}$ = the logarithm of annual government education expenditure (billion Rp.)
$\ln x_{2t}$ = the logarithm of annual number of population
$\ln x_{3t}$ = the logarithm of annual GDP per capita

	Coefficient	t-stat	Prob-t
β_1	0.296	3.40	0.003
β_2	0.987	18.92	0.000
β_3	0.166	2.27	0.035
F(3, 19) = 82444.53		R-squared = 0.9999	
Prob > F = 0.0000		Adj R-squared = 0.9999	

Source: Widjaja's STATA estimation

In Table 12, I estimate that the elasticity of government budget of skilled labor creation reached 0.296. This means that for every 100 percent increase of government expenditure on education, there is a 29.6 percent increase of college and university students generated from the government education expenditure.

The high value of the R-squared (0.99) shows that the model is a good one to explain the dependent variable. Also, the t-statistics for each independent variable are

very significant. The t-statistic for government expenditure is 3.40 with probability 0.003, the t-statistic for population is 18.92 with probability 0.000, and the t-statistic for GDP per capita is 2.27 with probability 0.035.

The Productivity Index

The final estimation is for the productivity index. The model is the same as the one used in Auerbach and Kotlikoff, who followed the estimation obtained by Welch (1979). The estimation model is in Table 13.

Table 13. Indonesia: The OLS Estimation of the Labor Productivity Index (Year 2000 Cross-Section Raw Data)

$$\ln y_i = \alpha + \beta_1 x_{1i} + \beta_2 x_{1i}^2 + \gamma h_i + \delta t + \varepsilon_i \quad (38)$$

where:

$\ln y_i$ = the logarithm of weekly labor earnings of full-time workers
x_{1i} = experience
x_{1i}^2 = squared of experience
h_i = weekly working hours
t = time trend

	Coeficient	t-stat	Prob-t
A	8.4493	391.024	0.000
β_1	0.1128	106.697	0.000
β_2	- 0.0012	-90.750	0.000
Γ	0.0305	118.282	0.000
Δ	0.2177	219.224	0.000
F(4,114676) = 21735.35		r-squared = 0.4312	
Prob > F = 0.0000		Adj r-squared = 0.4312	

Source : Widjaja's STATA estimation

The low r-squared value 0.4312 indicates that the model of Indonesian labor productivity index above is not a strong one. However, the two important parameters, β_1 and β_2, are

good estimators for the experience variables. Their t-statistic are high, and their probability is 0.000.

The productivity index equation can then be written as:

(39) PI(A) = Exp(8.4493 + 0.1128*Age(A) - 0.0012*(Age(A)**2) / Exp(8.4493)

where

PI = Productivity Index

A = Age

Exp = Exponential anti-log function

The productivity index measures the productivity of labor according to age and wages. Again, it is a linear combination between skilled and unskilled labor in the formal sector only. Wages become the measure of productivity here, and are treated as the dependent variable. Readers may see that the productivity index is positively related to age, A, but negatively related to the square of age, A^2, which means that the production capacity of laborers increases at the beginning and reaches its peak at certain age (age 47) before going down until they retire.

CHAPTER SIX

The Analysis of Sources of Financing

This chapter covers the analysis of ways the Indonesian government finances the pension program. As has been noted in Chapter Three, the program is a program that combines redistribution via a defined benefit type and a fully-funded defined contribution type. The redistribution program is intended to eliminate poverty among older people as well as to create an incentive for young individuals to save for their own future in the fully funded program. In this case, the redistribution program is financed through government budget. The savings purpose of the fully funded program may be financed by the individuals and by the institution where they work. In this chapter, I analyze how the Indonesian government should finance these programs.

Redistribution program. For the distribution program, there are three options of financing source to be made. Those options are to fund from corporate income taxes, from labor income taxes, and from consumption taxes. Based on several criteria, such as easiness to administer, sufficiency, sustainability, and excess burden, the choice falls on consumption taxes.

The government has two alternatives regarding the time of transferring the redistribution program. Those disbursement times are ex-ante retirement and ex-post retirement (Geanakoplos, Mitchell, and Zeldes, 1998). In the ex-ante retirement alternative, the government puts the funds in the worker's account every month during the working time of the worker. In term of incentives, ex-ante financing is preferable for workers. The ex-post retirement financing means that the government disburses the fund

to the retiree after they are retired. In terms of budget feasibility for the government, ex-post disbursement is preferable to ex-ante retirement. In doing the analysis, I assume that the Indonesian government chooses ex-post disbursement[9] The benefits for every pensioner are set equal across pensioners irrespective of how much they have contributed through the consumption tax. This type of benefit is known as a flat benefit.

***Fully funded program*.** The fully funded program is the actual pension program that I examine for the long run of the model. I expect that, as labor becomes more educated, the wages of labor become sufficiently high that laborers are able to self-finance their own pension. As more people get involved in the fully funded savings program, the central government is able to release the burden of cash transfers for minimum pension. For the fully funded savings pension program, since it has a strong connection between contributions and benefits, the financing is taken from the earmarked taxes on labor income. The benefit received from this program depends on the contribution of each person into their pension account.

The Financing of the Redistribution Program

The redistribution program is financed from the three sources of tax choices: corporate income taxes, labor income taxes, and consumption taxes. Included in the consumption tax is a value added tax, an excise tax, and a tax on luxurious goods. Since this is a redistribution defined benefit program, the source of financing does not have to

[9] Actually, if the government does not allow the retiree to disburse the pension fund before they retire, the ex-ante financing system can be transferred to the ex-post financing system.

be taxed from earmarked taxes, i.e., labor income. Before we proceed, let us see the pension necessity of retirees (Table 14).

Table 14. Indonesia: The Redistribution Financing Need Year 2000-2050

Year	Population Amount	Annual Benefit Provision (billion Rp)					
	Age 60+	World Bank Poverty Measures			Indonesia Poverty Lines		
	(million people)	USD 1/day	USD 2/day	USD 3/day	At 50 percent	At 100 percent	At 150 percent
2000	16.2	58.3	116.6	175.0	9.7	19.4	29.2
2005	18.6	67.0	133.9	200.9	16.7	33.5	50.2
2010	20.9	75.2	150.5	225.7	25.1	50.2	75.2
2015	24.4	87.8	175.7	263.5	36.6	73.2	109.8
2020	29.2	105.1	210.2	315.4	52.6	105.1	157.7
2025	34.6	124.6	249.1	373.7	72.7	145.3	218.0
2030	41.3	148.7	297.4	446.0	99.1	198.2	297.4
2035	48.3	173.9	347.8	521.6	130.4	260.8	391.2
2040	55.5	199.8	399.6	599.4	166.5	333.0	499.5
2045	62.2	223.9	447.8	671.8	205.3	410.5	615.8
2050	67.4	242.6	485.3	727.9	242.6	485.3	727.9

Source: a. "World population prospects: The 2006 revision population database
b. Maksum (n.d.)

Note: It is assumed that USD 1 = Rp. 10.000.
According to Central of Board Statistics calculation, the poverty lines increases by Rp 50.000 for every 5 years in 1999-2004, and this amount becomes the basis for inflation adjustment calculation in the table above.

Table 14 shows two alternative ways of calculating annual benefit provision for the cash transfer program. The first one is calculated from the World Bank's measurement of poverty, and the second one is calculated from the Indonesian Central Board of Statistics poverty line. The benefit calculation according to the Indonesian poverty line is low at the beginning, and the amount is lower than the benefit calculation from the World Bank's poverty measures. Later on, the benefit calculation according to Indonesian poverty lines increases gradually as the amount is adjusted to the inflation rate at Rp. 10.000 annually, or USD 1 per year.

The World Bank's measures of poverty are based on the daily income level, and the minimum amount at this time is USD 1 per day. I offer three alternative levels of benefit provision. In Table 6.1, the benefit USD 3 per day is the highest benefit that satisfies personal daily physical need. The amount USD 2 per day provides a minimum personal benefit, while USD 1 per day is below the necessity. Still, the benefit USD 1 per day is acceptable as part of the benefit since this benefit supports the benefit received from the fully funded system. Unlike the benefit calculation based on the Indonesian poverty line, the benefit calculation is kept constant for the whole year. For the first year, the amount provided to support USD 1 per day person is Rp 58.3 billion. This is the lowest amount for the first year according to the World Bank measures. However, this amount is still higher than the highest figure according to the poverty line measurement of the Indonesian Central Board of Statistics. For the source of financing, the choice of tax base is listed in Table 15. The amount is matched to the necessity from the first year.

Table 15. Indonesia: The Redistribution Financing Need Year 2000 (billion Rp.)

Tax Base	Base amount	Current tax revenue (CTR)	% from the base	CTR + minimum social security amount	% from the base
Corporate Income	391.1	184.2	47.1	242.5	61.9
Labor Income	641.8	11.4	1.8	69.7	10.8
Consumption Taxes	937.5	69.9	7.5	128.2	13.7

Source: "Sistem Neraca Sosial Ekonomi Indonesia 2000," 2003, calculated by Widjaja.

Again, there are three choices of the source of financing for social security redistribution purpose: corporate income, labor income, and consumption taxes. For

simulation purposes, the minimum amount of the social security benefit is added on top of the taxed amount.

Corporate income is the current most accessible source of taxes for the central government. The problem is that the current tax amount is already quite high, or 47 percent of the tax base. Adding the social security taxes on top of that creates a very high tax burden for firms in the private sector, and many firms might leave from the business sector or move to the informal business sector. Sustainability of social security taxes from this source is also not certain.

Labor income is the most difficult tax source for the central government to access. From the year 2000 social accounting matrix, the tax effort from labor income reached only 1.8 percent, less than 2 percent (Table 15). From the labor data in Chapter Five, roughly 65 percent of Indonesian laborers work in the informal sector, a sector that is largely excluded from government taxes. We also know that the informal goods sector is predicted to contribute to Indonesian GDP by 25 percent (Charmes, 2000). If the prediction regarding the GDP share of formal and informal sector is true, then the social security benefit would be sustainable if the government wa able to increase the base up to 70 percent of the total labor income. Adding the social security tax on top of year 2000 labor income tax increases the total tax effort into 10.8 percent.

However, there are problems with labor income taxation for redistribution. As the benefit may be relatively lower than the contributions, workers may want to move from the formal sector to the informal sector to avoid the taxes. As has already been discussed in the model construction in Chapter Four, the increase of wage taxes may reduce the value function of workers in the formal sector. If workers think that their value function

in the formal sector becomes lower than their value function in the informal sector, then they will move to the informal sector. The second problem with this tax source is that many workers' monthly salaries are too low, only sufficient to satisfy their physical needs without an additional premium to pay the taxes. The third problem arising from taxing labor income is that self-employed workers tend not to pay the additional social security taxes, as happened in the application of pay-as-you-go system in both the developed and developing countries applying the system.

The last source of taxes is consumption taxes. While the tax effort is fairly high, amounting to 7.5 percent of the consumption base, there are still some parts of the consumption base that fall in the informal goods production sector. It is not known how large is the consumption share of goods produced by the informal sector firms. Using Charmes (2000) prediction, I assume that the consumption of the goods produced in the formal sector reaches 75 percent of the Indonesian total consumption. This explains why the consumption tax base can still be increased. Adding the social security tax into the current tax revenue increases the tax effort into 13.7 percent. From the tax base amount, consumption taxes are predicted also as a sustainable source for the social security taxes and a relatively easy source of taxes to administer. Last, consumption taxes as the source of redistribution for social security have its own merit as a growth multiplier. The tax amount distributed to the retirees is partially being consumed directly, returning some part of the taxes to the economy. In turn, this multiplier effect will slightly decrease the tax effort ratio as the total amount of indirect tax base (in terms of consumption) increases.

Having reviewed all of the choices above, I conclude that consumption tax is the best choice among the three to be chosen as the tax base to serve the redistribution purpose of the social security program.

The Financing of the Savings Program

Since the savings program has a strong link between benefits and contributions, tax financing should be applicable on the labor income tax base. Therefore, the candidates for tax base are the corporate income and the labor income. The policy choices are either that the government charges 100 percent taxes on labor income or that is uses some combination of corporate income and labor income (50-50 percent) taxes. I assume the amount is 10 percent of the labor income. As has already been stated in Chapter Four, the amount of 10 percent is based on Law No. 11/1969 regarding the pension of civil servants. The Law states that civil servants pay 4.75 percent of their salary for the pension savings. I round up of this share to 5 percent, and then assume that the company or the central government matches the same amount of the 5 percent tax to the individual's pension account. From the social accounting matrix, it can be calculated that the average monthly labor income of skilled labor is Rp. 5 million. Ten percent of the income amount is Rp 500 thousand and 5 percent is Rp 250 thousand, which are then assumed to be affordable for a skilled labor in Indonesia; that is, saving Rp. 500 thousand monthly for 35 years will be sufficient for one person to have a decent living when retire.

As I already have reviewed, there are some advantages and disadvantages for each type of taxes. Due to a strong link between benefits and contributions for a fully funded savings pension program, I expect that there will be little movement of labor from

the formal sector to the informal sector after labor income taxation, especially for labor whose wages are at the margin between the two sectors. The detailed analysis is shown in Chapter Eight.

The Redistribution Issue

In the pay-as-you-go mandatory pension system, the redistribution of assets across cohorts (intergenerational redistribution) and the redistribution of assets within cohorts (intragenerational redistribution) takes place as the benefits are received and the taxes are paid by different individuals in different generations. As a consequence, the present value of the amount of taxes paid and the amount of benefits received will be different. The current tax rate and the future tax rate may or may not be the same. In order to calculate the intragenerational redistribution as well as the intergenerational redistribution, the pension taxes should be the type of earmarked taxes, i.e., taxes and transfer payments that can be traced to the individual.

This is, however, not the case for a fully funded mandatory system. In such a pension system, the pension is paid by taxpayers for themselves in the future, and the present value of taxes and benefits received will only differ if the rate of return on investment of the fund received from taxes is differ from the annual discount rate (i.e., inflation rate). The rate of return may be higher or lower than the discount rate. As an expectation value, in the long run both rates are expected to be equal, although in fact in many cases the fund manager is able to generate future profits from the pension fund. Therefore, the expected value of return on investment from the fully funded mandatory

system is assumed to be zero, and there is no redistribution in the system because the taxes paid are returned to the same individual in term of the future benefits.

In order to cover the weaknesses of fully funded mandatory system in terms of assets redistribution, the distribution aspect of the pension system is attached to it from other sources of taxes, such as consumption taxes, capital income taxes, and labor income taxes, depending on the feasibility of each tax type. As has been shown earlier, for the case of Indonesia indirect taxes are most feasible to be applied in the system. Such a system is called a mixed system between defined contributions and defined benefits as both aspects are introduced together into one package.

The redistribution that takes place in the mixed system can be considered a type of cash transfer, without any obligation from the recipient to pay any pension taxes in advance; that is, the benefit received is 100 percent of the transfers while the tax amount depends on how much the individual has already paid in the consumption taxes. However, consumption taxes are difficult to trace to an individual, and this depends on how much individuals spend of their income in the formal goods market. It is possible that an individual never pays the consumption taxes to the government and that he or she spends his or her income only in the informal goods market, where the government has no access to charge taxes. In that case, the redistribution of the benefit he or she receives could reach 100 percent.

The distribution of cash transfers for pension necessity should be as low as possible, only to provide the minimum physical needs, in order to motivate people to work in the formal sector and to create their own fully funded pension account. This type

of cash transfer should also be provided temporarily. As many people become able to create their own pension fund, the cash transfer should be discontinued.

The Creation of Skilled Labor (The Elimination of Informal Labor Sector)

Informality impedes the government's ability to implement fiscal policy and reduces the government's ability to collect from and provide transfers to individuals, including the tax and transfer for pension policy. The only way to eliminate the informal labor sector is to educate the new entry of working force up to the level of skilled labor, which is up to the education level of college and university students. As people become more educated, they would tend to refuse to enter the informal labor sector as the pay-off and benefit in that sector is much lower compared to that in the formal sector. In this case, I assume that the industry in the formal sector is able to absorb the amount of skilled labor provided or the skilled labor is able to find a job in the formal sector for themselves.

The overview of current labor markets shows that the capacity of education sector in Indonesia to provide the new skilled labor is very low; see Table 6.3 below. In year 2000, only 502 thousand people of age 20-24 in the working force received the degree of diploma I, II, III, and bachelor. In year 2001, the amount increases a little bit to 514 thousand people, in year 2002 the amount increases further to 546 thousand people, but decreases slightly in year 2003 to 543 thousand people. Compared to roughly 100 million people in the working force, roughly 500 thousand people is just 0.5 percent of the total working force.

At the same time, in year 2000 the amount of newly retired skilled labor (age 55-59) who have the degree of diploma I, II, III, and bachelor is 190 thousand people; in

year 2001, the amount is 192 thousand people, in 2002 it decreased to 178 thousand people, and in 2003 it increased to 191 thousand people.

Given this information, the annual average of additional amount of skilled labor is around 334 thousand people. Meanwhile, the stock of skilled labor in year 2000 is 3.24 million people, increasing to 3.30 million people in year 2001, increasing again in year 2002 to 3.34 million people, and reaching 3.40 million people in year 2003. I calculate the average net incremental of skilled labor, and get the result equal to around 10 percent of total skilled labor each year.

For the purpose of the elimination of a significant amount of labor in the informal sector within a certain time, say, by 25 percent of the current amount within 20 years, then the increment of total skilled labor by 10 percent annually is not sufficient. In year 2000, the amount of unskilled labor worked in the formal sector is 28.2 million people, or 8.2 times the amount of skilled labor worked in that sector. Still in year 2000, the amount of unskilled labor working in the informal sector is 58.6 million people, or 16.9 times the amount of skilled labor working in formal sector.

From year 2000 labor data, in order to eliminate 25 percent of unskilled labor in the informal sector, the government needs to generate an additional 15 million people of skilled labor. I assume that the job market is available for the skilled labor entering the formal sector, or that they can create one of their own. To eliminate 50 percent of unskilled labor in the informal sector, Indonesia needs to generate at least 29 million people of skilled labor. To eliminate 75 percent of unskilled labor, Indonesia needs an additional 44 million people skilled labor. To eliminate the whole informal sector means that the Indonesian government needs at least additional 58.6 million people. I also

Table 16. Indonesia: The Description of Labor Market Condition According to Age and Education (in Thousand People)

1999	>15	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	>60
Up to Primary School	43345	3510	5473	6068	5645	5536	4831	3903	2913	2027	3439
Junior High School	15485	1254	1955	2168	2017	1978	1726	1394	1041	724	1229
Senior High School	32887	2663	4152	4604	4283	4200	3666	2961	2210	1538	2609
Diploma: 1 & 2 year	127	10	16	18	16	16	14	11	9	6	10
Diploma: 3 Year	1298	105	164	182	169	166	145	117	87	61	103
Bachelor	2510	203	317	351	327	321	280	226	169	117	199
2000	**>15**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**>60**
Up to Primary School	44777	3688	5529	6198	5865	5940	5004	4063	3042	2096	3351
Junior High School	15997	1318	1975	2214	2095	2122	1788	1452	1087	749	1197
Senior High School	33974	2798	4195	4703	4450	4507	3797	3083	2308	1591	2542
Diploma: 1 & 2 year	131	11	16	18	17	17	15	12	9	6	10
Diploma: 3 Year	1341	110	166	186	176	178	150	122	91	63	100
Bachelor	2593	214	320	359	340	344	290	235	176	121	194
2001	**>15**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**>60**
Up to Primary School	45669	3720	5659	6038	5971	5913	5293	4262	3289	2116	3408
Junior High School	16315	1329	2022	2157	2133	2112	1891	1523	1175	756	1217
Senior High School	34650	2822	4294	4582	4530	4486	4016	3234	2496	1605	2585
Diploma: 1 & 2 year	133	11	17	18	17	17	15	12	10	6	10
Diploma: 3 Year	1368	111	169	181	179	177	159	128	99	63	102
Bachelor	2645	215	328	350	346	342	306	247	190	123	197

Table 16 (continued)

2002	>15	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	>60
Up to Primary School	45459	3273	6010	6138	6148	5783	5186	4123	3303	1959	3537
Junior High School	16240	1169	2147	2193	2197	2066	1853	1473	1180	700	1264
Senior High School	34491	2483	4560	4657	4665	4387	3934	3128	2506	1487	2684
Diploma: 1 & 2 year	133	10	18	18	18	17	15	12	10	6	10
Diploma: 3 Year	1361	98	180	184	184	173	155	123	99	59	106
Bachelor	2632	190	348	355	356	335	300	239	191	113	205
2003	**>15**	**15-19**	**20-24**	**25-29**	**30-34**	**35-39**	**40-44**	**45-49**	**50-54**	**55-59**	**>60**
Up to Primary School	47116	3643	5981	6083	6174	5992	5404	4391	3552	2106	3790
Junior High School	16832	1301	2137	2173	2205	2141	1931	1569	1269	752	1354
Senior High School	35748	2764	4538	4616	4684	4546	4100	3332	2695	1598	2876
Diploma: 1 & 2 year	138	11	17	18	18	17	16	13	10	6	11
Diploma: 3 Year	1411	109	179	182	185	179	162	132	106	63	114
Bachelor	2728	211	346	352	357	347	313	254	206	122	219

Source: Widjaja's calculation, from Indonesian Central Board of Statistics Raw Data.

assume in these calculations that the formal labor sector is able to employ the rest of the 28 million people of unskilled labor, as the sector will still need to employ that amount. Next, I analyze the impact of creating skilled labor on the government budget.

The Budget Impact of Skilled Labor Creation

The skilled labor creation will have an impact on government expenditures. On one hand, it will increase government expenditures for education. On the other hand, it will reduce the government expenditure for the redistribution of pension expenditures. I examine each issue.

The Education Budget. Given the price level and income level of year 2000, there are 3.3 million college and university students. For the government expenditures on education (Table 17) in year 2000, Rp. 6.4 trillion is spent to support 3.3 million college and university students. In year 2001, Rp. 4.4 trillion is expensed to support 2.9 million college and university students. In year 2002, Rp. 4.6 trillion is spent to support 3.4 million college and university students.

By using the elasticity of government expenditure on skilled labor creation estimated in Table 12, I estimate the additional amount of government budget for education of skilled labor. From Table 16 and Table 17, in year 2000 the government created 502 thousand skilled labors from 3.3 million college and university students, or 13.2 percent of skilled labor from the stock amount of college students. In year 2001, it created 514 thousand skilled laborers out of 2.9 million college and university students, or 17.7 percent of skilled labor. In year 2002, 546 thousand skilled labors were created

out of 3.4 million college and university students, or 16.1 percent. Finally, in year 2003, 543 thousand skilled labors were created out of 3.5 million college and university students, or 15.3 percent.

The average of skilled labor production over those 4 years is 15.6 percent annually. Therefore, in order to eliminate 25 percent of unskilled labor in the informal labor market, or to create around 15 million skilled laborers, Indonesia must educate around 96.2 million students at the college and university level.

Supposing that the creation of skilled labor occurs within 20 years of time, then the amount of college and university student must increase by 4.8 million people annually, or almost 1.5 times of the 2000-2003 average level or 3.3 million students. With an elasticity of government expenditure per skilled labor creation equal to 0.296, or roughly 0.3, then the government expenditure for the skilled labor creation should be increased by five times of the current average annual government education expenditure amount (Rp. 5.2 trillion), or an increase to a minimum Rp. 26 trillion annually.

By using the same argument, eliminating 50 percent of skilled labor within 20 years needs an increase of ten times government education expenditure to Rp. 52 trillion annually, eliminating 75 percent of skilled labor within 20 years needs an increase of fifteen times government education expenditure to Rp. 78 trillion annually, and eliminating 100 percent of skilled labor within 20 years needs an increase of forty times government education expenditure to Rp. 104 trillion annually. These calculations assume that the elasticity of GDP per capita towards skilled labor education does not change over time.

Still from Table 16, it can be seen that that the amount of government budget in year 2000 is Rp. 279.4 trillion, rising to Rp. 341.5 trillion in year 2001, to Rp. 345.6 trillion in year 2002, and to Rp. 370.6 trillion in year 2003. The annual average of government expenditure for the four years is Rp. 334.3 trillion. If the central government commits to set the increase of 25 percent skilled labor within 20 years, the education expenditures must be around Rp. 26 trillion out of Rp. 334.3 trillion, or a minimum 7.8 percent of the annual government budget. Therefore, the increase of 50 percent skilled labor within 20 years requires roughly 8 percent of the annual government budget. I assume that this increase is feasible.

Table 17. Indonesia: The Central Government Education Expenditure

Year	College and University Student (million people)	Government Education Expenditure (trillion Rp).	Government Total Expenditure (trillion Rp).	Share of Government Education Expenditure to Total Expenditure (percent)
1999	3.12	6.0	231.9	2.61
2000	3.33	6.4	279.4	2.91
2001	2.91	4.4	341.5	1.30
2002	3.40	4.6	345.6	1.32
2003	3.55	5.4	370.6	1.45
2004	3.70	19.2	430.0	4.46

Source: a. "Republic of Indonesia Financial Note and Central Government Budget " (various)
b. "The population of Indonesia" (various)

The Pension Budget. There is also an impact from the elimination of informal labor on the government cash transfers for retirees. The government will be able to cut its pension cash transfers to the working population who are able to pay for their own fully-funded future pension, which means that the elimination of labor who work in the informal sector through education will eradicate the pension burden on government budget as well.

Suppose that the government is able to eliminate 25 percent of year 2000 unskilled labor in the future, an amount of 15 million people who will retire in the year 2040. Supposed also that the government sets the cash transfer at 100 percent of the year 2040 poverty line. Then the amount that can be saved in the government budget from not paying the transfer to 15 million people is around Rp.100 billion annually (calculated from Table 6). Compare this to the increase of education expenditure for the same amount of skilled labor creation (or Rp. 26 trillion annually), the amount to be saved from pension expenditure is relatively small. However, one should also take into account the contribution of skilled labor to the GDP as they start entering the working force and start paying taxes revenue from their increased labor income.

CHAPTER SEVEN

The Analysis of the Calibration Results

The purposes of calibration in this chapter are first to look at the distribution of excess burden of welfare across generations before and after the consumption tax for cash transfers is imposed, and second to look at the amount (and the distribution across sectors) of labor in the economy before and after the tax. In doing so, I assume that workers are able to choose their optimal working hours due to changes in consumption tax. The assumption affects the behavioral parameter consumption share. The consumption share is the parameter that sets the amount of working hour spent by labor.[10] The model calibrated only skilled and unskilled labor in the formal production sector because data for production and labor are not available in the informal production sector.

The Distribution of Tax Burden across Generations

The distribution of excess burden here is calculated by using the Hicksian Equivalent Variation (EV). The EV means the minimum amount of monetary value needed to compensate the individual for different prices. The calibration is made for taxation under USD 1, USD 2, and USD 3 cash transfers. The calculation of Equivalent Variation assumes that an additional consumption tax is compensated by reducing the same amount of either capital income tax or labor income tax. Examples and formula of EV calculation can be found in Ballard, Fullerton, Shoven, and Whalley (1985) and Creedy (2003).

[10] Consumption expenditure equals wages multiplied by working hours. Aggregate consumption then equals the sum of labor amount multiplied by wages multiplied by working hours.

It is useful to make clear the relative magnitudes of the consumption tax and the cash transfers. For USD 1 cash transfer per day per person, the amount of additional consumption taxes collected is Rp. 58.3 billion for the year 2000. The amount becomes Rp. 116.6 billion for the USD 2 cash transfer and Rp. 174.9 billion for the USD 3 cash transfer. The year 2000 consumption expenditures are Rp. 937.5 billion, while the existing consumption taxes are Rp. 69.9 billion or 7.5 percent of the year 2000 consumption expenditures. If the central government charge taxes of Rp. 58.3 billion from the consumption expenditures, then the consumption taxes collected become Rp. 128.2 billion while the tax base becomes Rp. 879.2 billion. The tax effort becomes 14.6 percent (128.2 divided by 879.2), or almost twice as high as the initial consumption tax rate. For additional consumption taxes of Rp. 116.6 billion, the consumption taxes collected become Rp. 186.5 billion, while the tax base becomes Rp. 820.9 billion. The tax effort becomes 22.7 percent (186.5 divided by 820.9) after the additional consumption tax for USD 2 cash transfer. Finally, for additional consumption taxes Rp. 174.9 billion, the total consumption taxes amount equals Rp. 244.8 billion, while the tax base becomes Rp. 692.7 billion. The tax rate after a consumption tax for the USD 3 cash transfer is 35.3 percent (244.8 divided by 692.7).

Assuming that the additional consumption tax is financed by labor income, the additional consumption tax can be seen as another way to tax labor income. The year 2000 disposable labor income is Rp. 630.9 billion, with the initial tax amount Rp. 11.3 billion. The initial tax rate is 1.8 percent (11.3 divided by 630.9). Adding Rp. 58.3 billion, the labor tax amount increases to Rp. 69.6 billion, while the labor income reduces to Rp. 572.6. The labor income tax rate reaches 12.2 percent (69.6 divided by 572.6). By doing

the same calculation procedure, I get the labor income tax rate 24.9 percent and 40.8 percent after the additional consumption tax for the USD 2 cash transfer and the USD 3 cash transfer, respectively.

I assume in the calibration that labor is able to optimize their working hours after government sets additional consumption taxes. For notation examples of the generations, "-40" indicates the generation born 40 years before the policy takes place in year 0; generation "0" is the generation born in year 0; generation "40" is the generation born 40 years after the policy takes place in year 0. Terminal generations are the last generations in the sequence, generations "80" to "120". These generations are of particular importance because the EV values converged at these generations.[11]

USD 1 cash transfer. Under consumption tax for USD 1 cash transfer (Appendix B, Table B.1), the consumption tax rate increases to 14.6 percent. The skilled labor's EV is the same for both taxations under capital income and labor income compensations. The value of EV ranges from the smallest 0.00 percent at generation "-30" to the highest 0.32 percent at terminal generations. The total welfare gain for the whole generation of skilled labor is Rp. 69.18 billion at year 2000 prices. Still under consumption tax for USD 1 cash transfer, unskilled labor's EV is also the same for both taxation under capital income or labor income compensation. EV ranges from the smallest -0.01 percent at terminal generations to the highest 1.43 percent at the "5" and "10" generations. The total welfare loss for the whole generation of unskilled labor is Rp. 1.18 billion at year 2000 prices.

[11] Convergence is made to adjust the changes of the utility function to the changes of domestic interest rate towards the world interest rate due to the small open economy feature. For more information, see Rasmussen and Rutherford (2004).

Several things should be noted from these EV calculations for the consumption tax of USD 1 cash transfer. The EV under capital income compensation or labor income compensation is the same for both skilled and unskilled labor, which means that if labors are elastic towards their working hours, then welfare effect of consumption tax is indifferent whether financed by capital income or labor income taxes. Comparing both EV movements, skilled labor's EV has several peaks while unskilled labor's EV keeps going up to single peak (Appendix C, Figure C.1). In addition, the EV for unskilled labor is higher for both capital income and labor income compensation because the amount of unskilled labor is much higher than that of skilled labor. Meanwhile, the total welfare is negative for unskilled labor generations but positive for skilled labor generations, which means that under this consumption tax the skilled labor gets more of the benefits than does the unskilled labor. Finally, the current generation the unskilled labor gets more of the welfare benefit than the young as their EV is higher than the young's EV.

USD 2 cash transfer. Charging a consumption tax for the USD 2 cash transfer (Appendix B, Table B.2) increases the consumption tax rate to 22.7 percent of total consumption. As before, the skilled labor's EV is the same for both taxation under capital income or labor income compensation. The lowest EV, -0.90 percent, takes place at generation "-40", while the highest EV is 0.48 percent at generation "-20" and generation "65". The EV converges to 0.10 percent at terminal generations. The total welfare gain for the whole generation of skilled labor is Rp. 22.51 billion at year 2000 prices. Unskilled labor's EV is also the same for both taxation under capital income or labor income compensation. The lowest EV, -0.17 percent, takes place at terminal generations while the highest EV,

1.40 percent, takes place at generation "10". The total welfare gain for the whole generation of unskilled labor is negative Rp. 32.22 billion at year 2000 prices.

Note that the EV under capital income compensation or labor income compensation is the same for both skilled and unskilled labor. The movement of skilled labor's EV has more peaks compared to that of unskilled labor (Appendix C, Figure C.2). In addition, as happened under the EV calculation of the consumption taxes for the USD 1 cash transfer, the EV for unskilled labor is higher for both capital income and labor income compensation. Meanwhile, skilled labor generations get more benefits than their unskilled counterparts, as indicated by the total welfare gain. Finally, the current generation the unskilled labor gets more of the welfare benefit than the young as their EV is higher than the young's EV.

USD 3 cash transfer. The tax rate for the consumption tax for the USD 3 cash transfer is very high, reaching 35.2 percent. As previously happened, skilled labor's EV for taxation under capital income compensation is the same as under labor income (Appendix B, Table B.3). The lowest EV, -0.03 percent, takes place at generation "-25" while the highest, 0.64 percent, takes place at generations "70" and "75". The EV converges to 0.08 percent at terminal generations. The total welfare gain for the whole generation of skilled labor under capital income compensation is Rp. 17.94 billion at year 2000 prices. Unskilled labor's EV for taxation under capital income compensation is also the same as the one under labor income compensation. The lowest EV, -0.52 percent, takes place at terminal generations, while the highest EV, 1.40 percent, takes place at generation "5".

The total welfare loss for the whole generation of unskilled labor is Rp. 98.50 billion at year 2000 prices.

Note finally that the EV under capital income compensation is the same as the one under labor income compensation for both skilled and unskilled labor. Comparing the EV movement of the skilled labor and the unskilled labor, the one under skilled labor has several peaks, while the one under unskilled labor has only a single peak (Appendix C, Figure C.3). The EV for unskilled labor is higher under both capital income and labor income compensation, as the absolute amount of unskilled labor is higher than that of skilled labor. Skilled labor gets more of the benefit than unskilled labor as the absolute welfare gain is positive for skilled labor but negative for unskilled labor. Again, the current generation the unskilled labor gets more of the welfare benefit than the young as their EV is higher than the young's EV.

The Labor Amount after Taxation

The typical assumption in the labor amount analysis is similar to the one in EV analysis: labor is able to optimize their working hours after taxation. The labor analyzed here are again the skilled labor and unskilled labor in the formal production sector only because the profile of unskilled labor in the informal production sector is not available. The calibration here is first done under consumption taxes for USD 1, USD 2, and USD 3 cash transfers, in order to compare the results here with the earlier results.. I then do calibration under a fully funded savings pension program to observe which pension plan generates the maximum amount of labor in the formal production sector.

I start the analysis by setting the amount of labor at time 0 (the time when the policy starts) equal to 1.00 before the additional consumption tax for both skilled and unskilled labor is imposed. The 1.00 index represents 100 percent of the amount of labor at the initial condition. Due to the feature of CGE model, the growth of skilled and unskilled labor follows the growth of population in the model, constant at one percent annually or five percent for every time interval. This population growth holds before and after the additional consumption tax so that the initial ratio of skilled to unskilled labor also equals 1.00 for every time interval. This CGE feature simplifies the analysis because any changes of the first data in the observed series already represent changes of the rest. Notice that the initial consumption tax rate is 7.5 percent and the labor income tax rate is 1.8 percent.

USD 1 cash transfer. After the additional consumption tax for the USD 1 cash transfer, the consumption tax rate becomes 14.6 percent. Assuming that the consumption expenditure is financed by labor income, the additional consumption tax rate at 7.1 percent is equivalent to an additional labor income tax rate of 10.4 percent. The new labor income tax rate is 12.2 percent. At time 0, the index of skilled labor increases to 1.14, an increase of 14 percent from the base index, and the index of unskilled labor also increases to 1.15, an increase of 15 percent from the base index. This means that a consumption tax of USD 1 provides an incentive for labor, both skilled and unskilled, to enter the formal production sector. Additional consumption tax increases the purchasing price of the goods produced in the formal sector, and, in order to maintain utility, skilled and unskilled labor need higher wages that are available only in the formal production

sector. Notice that after taxation the index of unskilled labor increases slightly more than that of the skilled labor. The additional consumption tax for the USD 1 cash transfer slightly decreases the ratio of skilled to unskilled labor.

USD 2 cash transfer. An additional consumption tax for the USD 2 cash transfer generates a different impact on the labor amount in the formal production sector. The consumption tax rate becomes 22.7 percent, and its equivalent labor income tax rate becomes 24.9 percent. After the additional consumption tax, at time 0, the index of skilled labor still decreases to 0.82, 18 percent less than the initial index, and the index of unskilled labor also decreases to 0.85, a 15 percent decrease from the initial index. Notice that after taxation, it is the skilled labor that leaves the formal production sector the most.

USD 3 cash transfer. An additional consumption tax for USD 3 cash transfer also provides incentives for labor to leave the formal production sector. The consumption tax rate reaches 35.2 percent and its equivalent labor income tax rate reaches 40.8 percent. At time 0, the index of skilled labor amount goes down to 0.78, and the index of unskilled labor amount goes down as well into 0.75. Compared to the decreasing rate of the consumption tax for the USD 2 cash transfer, the decreasing rate of skilled labor is 22 percent, but unskilled labor increases into 25 percent. Clearly, a consumption tax rate that is too high prompts unskilled labor to leaves the formal sector the most. As a result, the ratio of skilled labor to unskilled index increases.

Summary. Which policy is optimal? If the goal of this policy is to provide incentives for labor to enter the formal production sector, then the calibration result predicts that a consumption tax that finances the USD 1 cash transfer provides the highest incentives for labor to work in the formal sector. Its amount of skilled labor and unskilled labor is the highest among the three policies, and also higher than the initial labor amount. An additional consumption tax for the USD 2 cash transfer provides incentives for both types of labor to leave the formal production sector so that it is not a good policy choice. The consumption tax for the USD 3 cash transfer is also not a good choice since it provides incentives for both skilled and unskilled labors to leave the formal production sector, with unskilled labors leaving the most.

The Mandatory Fully Funded Pension Policy

Even though it is a mandatory pension program, a fully funded pension is a type of savings program, different from a pay-as-you-go pension system. It changes the relative price of consumption today and consumption in the retirement. However, because it is a "forced" savings plan and here involves taxation of labor income, the set-up is assumed to be based on the principle of the highest amount of labor in the formal production sector, for both skilled and unskilled labors type.

This mandatory fully funded pension set-up comes after the consumption tax is determined because only labor that has a relatively high income (e.g., a minimum average Rp. 60 million annually, using the standard of average skilled labor in Indonesia) can participate in the fully funded pension fund. At the beginning of the program, not all labor is able to participate in the fully funded pension program. Most of the labor that is

able to participate at the beginning is skilled labor, whose labor income is relatively high. Later on as the program develops, it is expected that other labor will be included in each group. The fully funded pension program will gradually replace the cash transfer pension. Sometime in the future, as each labor has sufficient individual pension savings, the cash transfer program is expected to be terminated. Therefore, the set-up of the fully funded pension savings follows the best set-up of the consumption tax system that provides the highest incentives for labor to work in the formal production sector.

The analysis of the fully funded pension set-up also based on assumption that laborers are able to adjust their working hours. It is also assumed that the central government has already chosen and run the consumption tax for the USD 1 cash transfer. Because the fully funded pension plan links the contribution and the benefit, I analyze the pension set up under 100 percent labor income finance (fully paid by the labor) and fifty-fifty finance (50 percent paid by the labor - 50 percent paid by the firm). The tax rate is 10 percent of skilled labor income, or Rp. 20.6 billion. As has been discussed in Chapter Six, the 10 percent rate is based on the Law No. 11/1969.

The initial labor income tax rate after the consumption tax for the USD 1 cash transfer is 12.2 percent, while the corporate capital income tax rate is 34.0 percent. Additional fully funded savings tax of Rp. 20.6 billion increases the labor income tax rate to 16.3 percent, while an additional Rp. 10.3 billion increases the labor income tax rate to 14.2 percent. Finally, an additional Rp. 10.3 billion fully funded savings tax increases the capital income tax rate to 36.6 percent.

The result for the additional fully funded pension savings simulation is shown in Appendix B, Table B.4. After the government charges 10 percent taxes on fully funded

savings, the labor income tax rate becomes 16.3 percent, and the index of skilled labor decreases to 1.02 from 1.14, a decrease of 0.12 index points or a 10.5 percent decrease of skilled labor. Meanwhile, the index of unskilled labor decreases as well from 1.15 to 1.01, a decrease of 0.14 index points or 12.2 percent of unskilled labor. Because the tax is taken fully from the labor income, the reduction of the labor amount is purely the effect of labor movement between sectors of production.

Still from Appendix B, Table B.4, the additional 50-50 funding of fully funded pension savings taxes shows that the additional taxes reduces the index of skilled labor from 1.14 into 0.69, a reduction of 0.45 index points or 39.5 percent of skilled labor amount. The taxation also reduces the index of unskilled labor from 1.15 to 0.73, a reduction of 0.42 index points or 36.5 percent of unskilled labor amount. At this time, the labor income tax rate is 14.2 percent, and the capital income tax rate is 36.6 percent. Because the taxes reduce both capital and labor income, the effect of labor reduction in this case is due to the movement of firms from the formal sector to the informal sector, as well as to the movement of labor themselves. The capital income tax rate is already quite high in the initial equilibrium, so that firms could not bear any additional expense for labor pension anymore.

Several Issues on Informal Production Sector

The informal production sector is a grey area of the economy of developing countries; that is, informal production exists but its magnitude existence is unknown. It is difficult to measure the output of that sector as production, as well as the number of individuals or firms, is not reported to or registered by the government (Palmade and

Anayiotos, 2005). Firms operating in the informal production sector can be divided into two types: quasi informal sector and real informal sector. Firms in the quasi informal sector are capable of operating in the formal production sector but for some reasons, like tax avoidance, they stay in the informal production sector. They have some significant amounts of capital and some significant amounts of labor. In contrast, firms in the real informal sector have little capital and labor, and may quit business easily (Azuma and Grossman, 2002). In the model building in Chapter Four, I assume that all firms are homogenous, as is typical of the real informal sector. This assumption holds as the government actually can easily observe large quasi informal sector firms, in term of both labor and capital, and can require them move to the formal sector.

The real informal sector firms find it difficult to accumulate capital in the long run. In addition to that, wages and productivity of labor become unobservable. Therefore, it is relatively difficult to construct an applied production model of the real informal sector that predicts the movement of capital and labor. However, the amount of labor in the informal sector can be inferred from the amount of labor that works in the formal sector. Although skilled and unskilled labors exist in the informal sector, most of the labor in the informal sector is of typically unskilled. Only a small amount of skilled labor works in the informal sector, i.e., only 0.5 percent of the total labor for the case of Indonesian labor. The sum of the percentages of skilled labor in the formal sector, unskilled labor in the formal sector, and unskilled labor in the informal sector is obviously equal to 100 percent. Therefore, if there is a decrease in the amount of total (skilled or unskilled) labor in the formal sector, readers may infer that the amount of labor in the informal sector increases. This is the approach taken here.

CHAPTER EIGHT

The Analysis of Economic Growth

Economic growth is affected by several aspects of the central government behavior in setting up the pension plans that I have examined. In Chapter Eight, I analyze the impact of creating skilled labor on economic growth, followed by an analysis of the impact of taxing additional consumption for cash transfers on economic growth, and concluding with an analysis of the impact of setting up the fully funded pension plan on economic growth.

Creating Skilled Labor

From the year 2000 Indonesian Social Accounting Matrix (size 38*38), it can be estimated that the income of skilled labor in that year is Rp. 206.9 trillion. With 3.45 million skilled laborers, the average income per skilled labor is Rp. 59.97 million, or roughly Rp. 60 million per year.[12] In the same year, the total income of unskilled laborers in the formal sector is 190.5 trillion, and the amount of unskilled labor in the formal sector is 28.21 million people, so that the average income of unskilled labor in the formal sector in year 2000 is Rp. 6.7 million per year.

Now suppose that the government is able to increase skilled workers by 0.75 million people annually, according to the target scenario I have discussed earlier. Assume also that the job market is able to absorb these amounts of labor. The implication is that this policy will increase the total income of labor by 0.75 million times Rp. 53.3 million (the difference between skilled labor and unskilled labor income), equal to roughly Rp.

[12] This amount equals to USD 6000 per year with the exchange rate Rp. 10.000 per USD.

40 trillion per year. In terms of GDP, this increase is roughly equal to 3.2 percent of year 2000 Indonesian GDP. (Indonesian year 2000 GDP equals Rp. 1,264.9 trillion.)

Comparing the increase of the value added of labor (Rp. 40 trillion) to the government expenditure needed to create this amount of skilled labor (Rp. 26 trillion), I evaluate that the contribution of the skilled labor income to the economy outweighs the government expenditure. In turn, the increase of labor income will increase consumption expenditure. Since the average consumption expenditure in Indonesia is 60 percent to 70 percent of GDP, I assume that the increase in labor income would also increase the consumption expenditure around 60 percent times Rp. 40 trillion, or Rp. 24 trillion. An increase of Rp. 24 trillion in consumption expenditure equals an increase of 2.5 percent of year 2000 consumption expenditure (Rp. 937.5 trillion). Assume also that the central government charges a 7 percent consumption tax on the increase of consumption, where the 7 percent rate is the year 2000 tax effort on consumption expenditure. The additional government revenue from an increase in consumption taxes is Rp. 1.7 trillion, or an increase of 0.85 percent of year 2000 of the central government tax revenue (Rp.195.5 trillion).

Providing Cash Transfers

However, the government effort to redistribute income through the increase in the consumption tax would probably have a negative impact on economic growth. Suppose that the central government is able to collect the Rp 58.3 trillion for the USD 1 per day cash transfer and redistribute them to the retired population. This amount equals 6.2 percent of year 2000 consumption expenditure. For the retired population, the amount is

considered as an income. Therefore, there is a possibility that they would not expend all the cash transfer into consumption. Following the average consumption expenditure of income, suppose that they expend only 60 percent of the cash transfers so that they reduce the consumption amount by 40 percent of Rp. 58.3 trillion or Rp. 23.3 trillion. The transfers would probably reduce the year 2000 Indonesian GDP by 1.8 percent. However, because the amount of transfer is relatively a small portion of individuals' monthly expenditures (or only Rp. 300 thousand per month), it would probably be spent fully for individual consumption. In the latter case, the transfer would not cause a negative impact on economic growth because all the transfers are turn back into consumption.

Establishing a Fully Funded Savings System

Finally, in the case of a fully funded savings system, in the short run this reduces current consumption and increases savings. Also because there is only little information regarding how savings are turned into investment in Indonesia, I predict that the increase in savings will reduce economic growth in the short run. If the fully funded pension program takes 10 percent of skilled labor income into savings, or around Rp. 20.7 trillion, it would reduce the year 2000 Indonesian GDP by the same amount, or 1.6 percent. However, within 20 to 30 years, as skilled labor retires, the savings would be turned into cash and spent in terms of consumption again, so it is like transferring the current consumption into future consumption. The current economic growth is reduced by the fully funded program, but the future consumption would likely increase. In this case, I assume that the pension fund institutions are trustable, so that they would invest the

savings fund in a profitable manner and keep the fund intact until the time of disbursement.

CHAPTER NINE

Final Conclusions

As the absolute and relative amount of the retired population increases in Indonesia, there emerges a need for Indonesia to have an integrated pension program. Support from family members for the elderly would be discontinued eventually because the amount of children in one family is getting smaller, the elderly live longer, and the family is becoming more and more fragmented, as children are no longer live with their parents after married (McKee, 2006). The pension program must fit the characteristics of Indonesia as a developing country, where output markets and labor markets are massive in the informal sector. As the central government has little ability to collect taxes in the informal sector, any social security taxation in the formal sector could make firms and labor move from a formal sector to an informal sector. Therefore, an investigation of the type of pension reform and its financing is necessary. This is the broad purpose of this dissertation.

Experiences from developing countries like Argentina, Brazil, Chile, Mexico, and China have shown that a combination of defined benefits in one program and defined contributions in another program can fit the pension system for a country with a massive informal sector, both in the output market and in the labor market. The two programs together serve the redistribution purpose on the one hand and the savings purpose on the other hand. The separation of the purposes is meant to prevent the application of a pension system causing labor and firms to move to the informal sector, as well as to

maintain the sustainability of the program by insulating the program from the aging problem.

Using an overlapping generation model, the analysis of sources of financing for the Indonesian redistribution program shows that consumption tax financing fits the main criteria as the source of redistribution financing. One implication of the additional taxation on consumption is additional burdens on generations. As generations distribute the tax burden among them, the analysis of equivalent variation for the tax burden distribution shows that skilled labor generations bear fewer burdens than that of unskilled labor under a consumption tax that finances a USD 1 cash transfer (a 14.6 percent consumption tax rate), under a consumption tax for a USD 2 cash transfer (a 24.9 percent consumption tax rate), and under a consumption tax for a USD 3 cash transfer (a35.3 percent consumption tax rate).

The analysis of the impact of a consumption tax on the amount of skilled and unskilled labor shows that the consumption tax for a USD 1 cash transfer provides the highest incentives for the skilled and unskilled labor to work in the formal sector, an increase by 14 percent skilled labor and 15 percent unskilled labor. The consumption tax rate is 14.6 percent, and its equivalent labor income tax rate is 12.2 percent. The consumption tax for a USD 2 cash transfer would decrease by 18 percent skilled labor and by 15 percent of unskilled labor in the formal sector, while the consumption tax for a USD 3 cash transfer would decrease skilled labor by 22 percent and unskilled labor by 25 percent. In addition, the set up of a fully-funded pension after the consumption tax for the USD 1 cash transfer shows 100 percent labor income financing is the one that provides the highest incentives for skilled and unskilled labor to work in the formal sector. In

contrast, an alternative financing split of 50 percent labor income tax and 50 percent capital income financing would stimulate the firms and both skilled and unskilled labor to leave the formal sector. The initial tax rate of capital income has already been too high, so that any additional tax rate for pensions would move the firms to the informal sector.

For the fully funded pension system to work in a long run, say, over 50 years, there is a requirement that the size of formal labor sector is wide enough and the amount of skilled labor supporting it is vast enough. There is no standard benchmark, but here I set 25 percent of total labor as skilled labor for the minimum requirement. The effort to reach 25 percent of total labor within 20 years (or 1.25 percent annually) will require 8 percent of annual government budgets be devoted to education. By using the average of year 2000-2003 government budget, this amount equals Rp. 26 billion per year.

For the analysis of economic growth, skilled labor creation to eliminate 25 percent of labor in the informal sector would increase labor value added by Rp. 39 billion, or 3.1 percent of year 2000 GDP. In the future (year 2040), if the government plans to reduce cash transfers to individuals, the amount that can be saved in the government budget from not paying the transfer is Rp. 100 billion per year, assuming that the transfer is at 100 percent of poverty line. However, the increase of the consumption tax rate for redistribution would probably reduce the economic growth by the average savings rate multiplied by the consumption tax rate. The smaller the savings rate, the lower is economic growth, as the additional consumption tax rate has been targeted. In addition, the application of a fully funded savings pension plan would also reduce the current economic growth but would likely increase the future one when the pensioners disburse their savings from the pension plan.

Finally, there are two propositions that I can contribute to the theory of public finance. First, in an economy with a large informal production and labor sector, consumption taxes are preferable to income taxation because my results indicate that consumption taxes are more likely to induce the movement of labor to the formal sector. In addition, the consumption tax must be paid in some way by every household whether they produce in the formal sector or informal sector. Second, given formal and informal labor markets in an economy, where the informal labor market is dominant; there exists an optimal consumption tax rate that provides an incentive to the highest amount of labor to work in the formal sector. It is time and the application of taxation that will prove the accuracy of these two propositions.

Appendix A
Examples of Country with Formal - Informal Labor Economy
Running Defined Benefit and Defined Contribution Pension System

Countries	Funding	Contribution	Benefits
		Percent of Employees Earning	
Argentina	Multi-pillar system		
	Pillar 1 : Flat Benefit	6 percent -16 percent paid by employee	Flat - 30 percent of male average wage
	Pillar 2 : Funded Individual Accounts	11 percent paid by employee	annuity
	many private funds		minimum benefit $140 after 10 years' service
Brazil	Two main regimes :		
	Private Sector Workers (RGPS)	8 percent paid by the employer	minimum wage or
	pay-as-you-go basis	some amount by employees up to	average of last 3 year wage
		a ceiling, min 30 years contribution	
	Civil Servant (RPPS)	11 percent paid by the employees	
Chile	Multi-pillar system		
	Pillar 1 : Minimum Pension Guarantee (MPG)	Financed from Gov general revenues	MPG (27 percent of male average wage)
	Pillar 2 : Funded Individual Accounts	13 percent paid by employee	annuity
	many private funds		
China	Multi-pillar system		
	Pillar 1 : Minimum Pension Guarantee (MPG)	Financed from employer's account by	20 percent of average wage
		17 percent of employee's wage,	
		min 15 years of working time	
	Pillar 2 : Funded Individual Accounts	employer contribution : 3 percent of wage	
		employee contribution : 8 percent of wage	

Appendix A (continued)

Countries	Funding	Contribution	Benefits
		Percent of Employees Earning	
Mexico	Multi-pillar system		
	Pillar 1 : Social Quota (SQ) +	5.5% of minimum wage paid by Gov	annuity
	Minimum Pension Guarantee (MPG)		
	Pillar 2 : Funded Individual Accounts	6.5% paid by employee	annuity
	Many private funds		1 minimum wage after 25 years' contribution

Source : Dunaway and Arora (2007), Filho (2005), James et al. (2003)

Appendix B
The Calibration Results

Table B.1
The Percent Change of the Equivalent Variation
Of Skilled and Unskilled Labor in the Formal Sector
Of Additional Consumption Tax
USD 1 Cash Transfer

	Skilled Labor		Unskilled Labor	
Generation	Capital Income Compensated	Labor Income Compensated	Capital Income Compensated	Labor Income Compensated
-40	0.26	0.26	0.93	0.93
-35	0.26	0.26	1.08	1.08
-30	0.00	0.00	1.03	1.03
-25	0.07	0.07	1.16	1.16
-20	0.11	0.11	1.23	1.23
-15	0.25	0.25	1.30	1.30
-10	0.05	0.05	1.39	1.39
-5	0.16	0.16	1.38	1.38
-0	0.07	0.07	1.35	1.35
5	0.08	0.08	1.43	1.43
10	0.09	0.09	1.43	1.43
15	0.10	0.10	1.42	1.42
20	0.10	0.10	1.40	1.40
25	0.11	0.11	1.36	1.36
30	0.11	0.11	1.31	1.31
35	0.12	0.12	1.25	1.25
40	0.12	0.12	1.18	1.18
45	0.13	0.13	1.08	1.08
50	0.15	0.15	0.97	0.97
55	0.17	0.17	0.83	0.83
60	0.19	0.19	0.68	0.68
65	0.21	0.21	0.52	0.52
70	0.24	0.24	0.34	0.34
75	0.27	0.27	0.17	0.17
80	0.32	0.32	-0.01	-0.01
85	0.32	0.32	-0.01	-0.01
90	0.32	0.32	-0.01	-0.01
95	0.32	0.32	-0.01	-0.01
100	0.32	0.32	-0.01	-0.01
105	0.32	0.32	-0.01	-0.01
110	0.32	0.32	-0.01	-0.01
115	0.32	0.32	-0.01	-0.01
120	0.32	0.32	-0.01	-0.01
Welfare Gain	69.18	69.18	-1.18	-1.18
2000 Rp Billion				

Source : Widjaja, calibration result.

Table B.2
The Percent Change of the Equivalent Variation
Of Skilled and Unskilled Labor in the Formal Sector
Of Additional Consumption Tax
USD 2 Cash Transfer

	Skilled Labor		Unskilled Labor	
Generation	**Capital Income Compensated**	**Labor Income Compensated**	**Capital Income Compensated**	**Labor Income Compensated**
-40	-0.90	-0.90	0.86	0.86
-35	0.75	0.75	1.04	1.04
-30	-0.12	-0.12	1.00	1.00
-25	-0.04	-0.04	1.13	1.13
-20	0.48	0.48	1.18	1.18
-15	0.38	0.38	1.25	1.25
-10	0.10	0.10	1.33	1.33
-5	-0.29	-0.29	1.31	1.31
0	0.13	0.13	1.29	1.29
5	0.12	0.12	1.38	1.38
10	0.15	0.15	1.40	1.40
15	0.14	0.14	1.39	1.39
20	0.12	0.12	1.38	1.38
25	0.11	0.11	1.35	1.35
30	0.10	0.10	1.30	1.30
35	0.10	0.10	1.23	1.23
40	0.14	0.14	1.13	1.13
45	0.18	0.18	1.02	1.02
50	0.23	0.23	0.89	0.89
55	0.29	0.29	0.74	0.74
60	0.37	0.37	0.56	0.56
65	0.48	0.48	0.44	0.44
70	-0.10	-0.10	0.23	0.23
75	-0.01	-0.01	0.55	0.55
80	0.10	0.10	-0.17	-0.17
85	0.10	0.10	-0.17	-0.17
90	0.10	0.10	-0.17	-0.17
95	0.10	0.10	-0.17	-0.17
100	0.10	0.10	-0.17	-0.17
105	0.10	0.10	-0.17	-0.17
110	0.10	0.10	-0.17	-0.17
115	0.10	0.10	-0.17	-0.17
120	0.10	0.10	-0.17	-0.17
Welfare Gain	22.51	22.51	-32.22	-32.22
2000 Rp Billion				

Source : Widjaja, calibration result.

Table B.3
The Percent Change of the Equivalent Variation
Of Skilled and Unskilled Labor in the Formal Sector
Of Additional Consumption Tax
USD 3 Cash Transfer

	Skilled Labor		Unskilled Labor	
Generation	**Capital Income Compensated**	**Labor Income Compensated**	**Capital Income Compensated**	**Labor Income Compensated**
-40	0.35	0.35	0.91	0.91
-35	0.17	0.17	1.07	1.07
-30	-0.02	-0.02	1.03	1.03
-25	-0.03	-0.03	1.15	1.15
-20	0.24	0.24	1.23	1.23
-15	0.21	0.21	1.29	1.29
-10	0.10	0.10	1.37	1.37
-5	0.15	0.15	1.35	1.35
0	0.06	0.06	1.32	1.32
5	0.07	0.07	1.40	1.40
10	0.10	0.10	1.37	1.37
15	0.11	0.11	1.33	1.33
20	0.11	0.11	1.28	1.28
25	0.12	0.12	1.20	1.20
30	0.13	0.13	1.11	1.11
35	0.14	0.14	0.99	0.99
40	0.15	0.15	0.83	0.83
45	0.17	0.17	0.65	0.65
50	0.20	0.20	0.45	0.45
55	0.25	0.25	0.22	0.22
60	0.33	0.33	0.20	0.20
65	0.38	0.38	-0.27	-0.27
70	0.64	0.64	-0.52	-0.52
75	0.64	0.64	-0.52	-0.52
80	0.08	0.08	-0.52	-0.52
85	0.08	0.08	-0.52	-0.52
90	0.08	0.08	-0.52	-0.52
95	0.08	0.08	-0.52	-0.52
100	0.08	0.08	-0.52	-0.52
105	0.08	0.08	-0.52	-0.52
110	0.08	0.08	-0.52	-0.52
115	0.08	0.08	-0.52	-0.52
120	0.08	0.08	-0.52	-0.52
Welfare Gain	17.94	17.94	-98.50	-98.50
2000 Rp Billion				

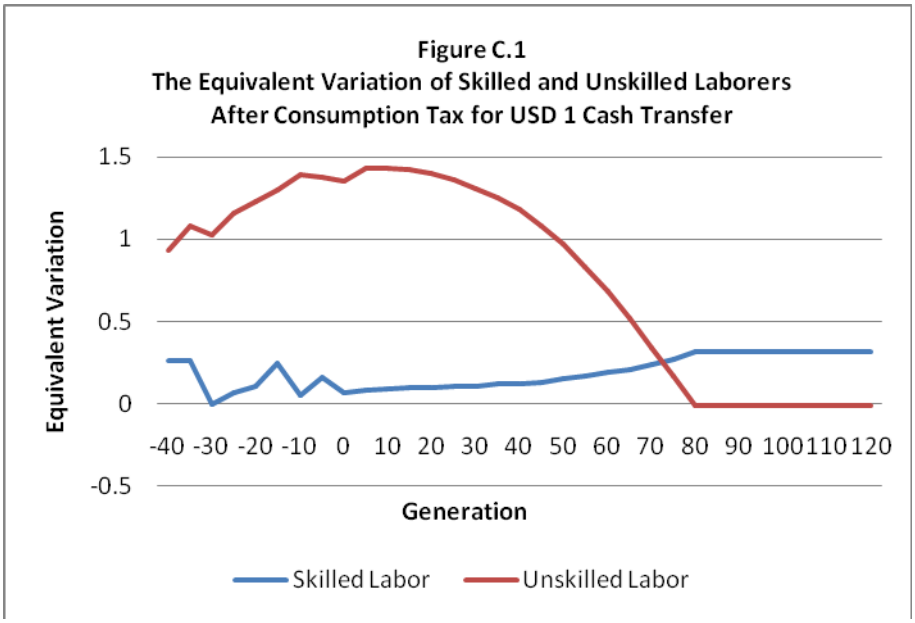
Source : Widjaja, calibration result.

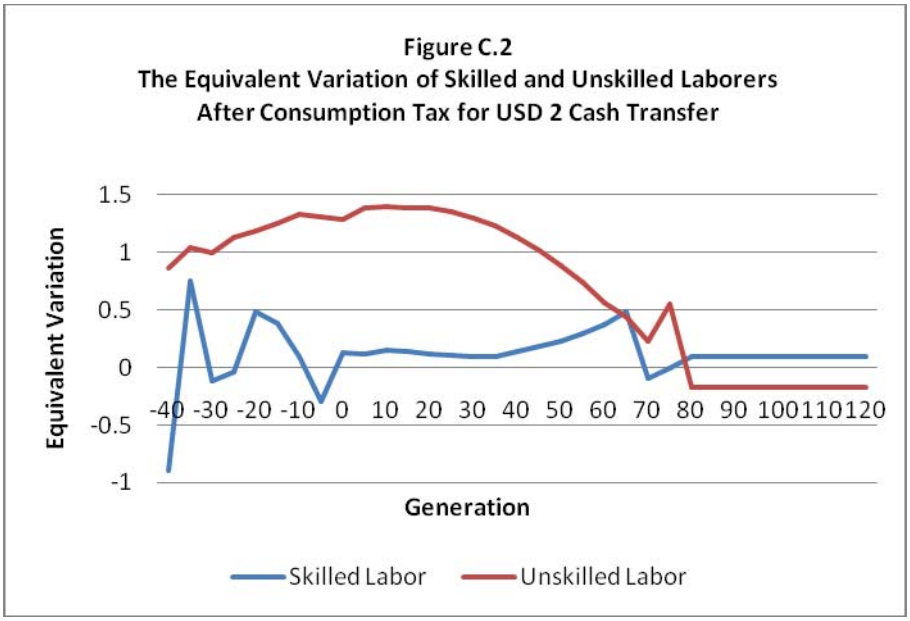
Table B.4
The Amount of Labor (percent)
After Additional Consumption Tax and Fully Funded Pension Tax

	Before Consumption Tax		After Consumption Tax						Fully Funded Pension Savings After USD 1 Consumption Tax			
			USD 1 per day person Transfer		USD 2 per day person Transfer		USD 3 per day person Transfer		10 percent Labor Income		5 percent Labor Income and 5 percent Capital Income	
Year	LS(T)	LU(T)	LS(T)	LU(T)	LS(T)	LU(T)	LS(T)	LU(T)	LS(T)	LU(T)	LS(T)	LU(T)
0	1.00	1.00	1.14	1.15	0.82	0.85	0.78	0.75	1.02	1.01	0.69	0.73
5	1.05	1.05	1.20	1.21	0.86	0.89	0.82	0.78	1.07	1.07	0.73	0.77
10	1.10	1.10	1.26	1.27	0.91	0.94	0.87	0.82	1.12	1.12	0.77	0.81
15	1.16	1.16	1.32	1.33	0.95	0.98	0.91	0.87	1.18	1.18	0.81	0.85
20	1.22	1.22	1.39	1.40	1.00	1.03	0.96	0.91	1.24	1.24	0.85	0.89
25	1.28	1.28	1.46	1.47	1.05	1.09	1.00	0.96	1.31	1.30	0.89	0.94
30	1.35	1.35	1.54	1.55	1.11	1.14	1.06	1.01	1.37	1.37	0.93	0.99
35	1.42	1.42	1.62	1.63	1.16	1.20	1.11	1.06	1.44	1.44	0.98	1.04
40	1.49	1.49	1.70	1.71	1.22	1.26	1.17	1.11	1.52	1.51	1.03	1.09
45	1.56	1.56	1.78	1.80	1.28	1.33	1.23	1.17	1.59	1.59	1.09	1.15
50	1.64	1.64	1.88	1.89	1.35	1.39	1.29	1.23	1.67	1.67	1.14	1.20
55	1.73	1.73	1.97	1.99	1.42	1.46	1.35	1.29	1.76	1.75	1.20	1.27
60	1.82	1.82	2.07	2.09	1.49	1.54	1.42	1.35	1.85	1.84	1.26	1.33
65	1.91	1.91	2.18	2.15	1.57	1.62	1.50	1.42	1.94	1.94	1.32	1.40
70	2.01	2.01	2.29	2.31	1.65	1.70	1.57	1.50	2.04	2.04	1.39	1.47
75	2.11	2.11	2.41	2.42	1.73	1.79	1.65	1.57	2.15	2.14	1.46	1.54
80	2.22	2.22	2.53	2.55	1.82	1.88	1.74	1.65	2.26	2.25	1.54	1.62
85	2.33	2.33	2.66	2.68	1.91	1.97	1.83	1.74	2.37	2.36	1.62	1.71
90	2.45	2.45	2.79	2.81	2.01	2.08	1.92	1.83	2.49	2.48	1.70	1.79
95	2.57	2.57	2.93	2.96	2.11	2.18	2.02	1.92	2.62	2.61	1.78	1.88
100	2.70	2.70	3.08	3.11	2.22	2.29	2.12	2.02	2.75	2.74	1.88	1.98
105	2.84	2.84	3.24	3.27	2.33	2.41	2.23	2.12	2.89	2.88	1.97	2.08
110	2.99	2.99	3.41	3.43	2.45	2.53	2.34	2.23	3.04	3.03	2.07	2.19
115	3.14	3.14	3.58	3.61	2.58	2.66	2.46	2.34	3.20	3.18	2.18	2.30
120	3.30	3.30	3.76	3.79	2.71	2.80	2.59	2.46	3.36	3.35	2.29	2.42

Source: Widjaja, calibration result.
Note: LS(T) = formal sector skilled labor amount; LU(T) = formal sector unskilled labor amount

Appendix C
The Figures





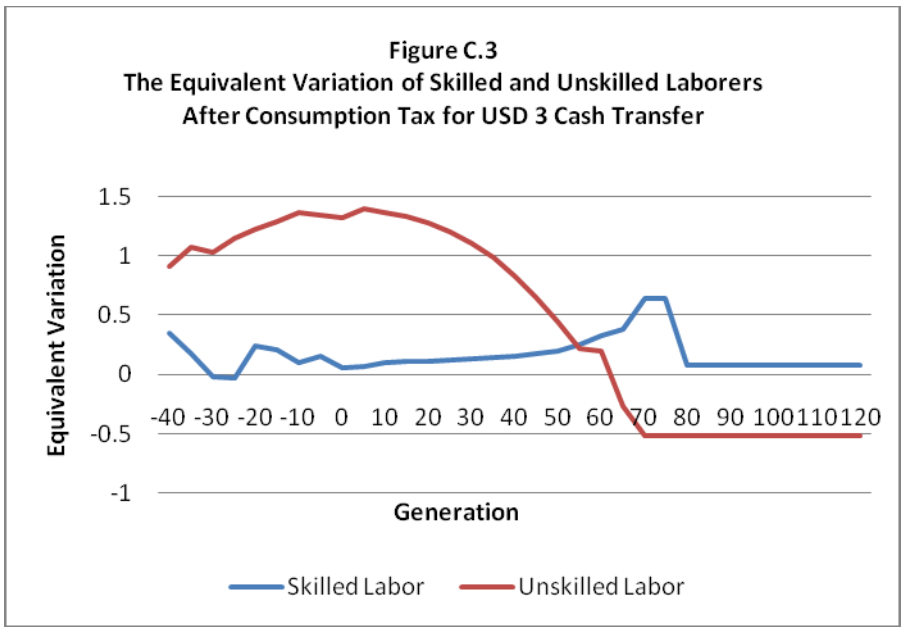


Figure C.3
The Equivalent Variation of Skilled and Unskilled Laborers
After Consumption Tax for USD 3 Cash Transfer
Equivalent Variation
1.5
1
0.5
0
-0.5
-1
-40 -30 -20 -10 0 10 20 30 40 50 60 70 80 90 100 110 120
Generation
Skilled Labor
Unskilled Labor

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Muliadi Widjaja was born in 1970 in Jakarta, Indonesia and received his PhD degree in economics from Economics Department, Georgia State University, in 2007. Before, he received his master degree in economics in year 2002 from the same institution. His bachelor degree in economics was granted in year 1997 from Economics Department, University of Indonesia. At Georgia State University, his graduate studies are specialized in the area of public finance, while at University of Indonesia, his undergraduate study is specialized in monetary economics. His PhD dissertation is in the area of pension system for developing countries with special case of Indonesia, applying the macroeconomic dynamic CGE method in the model.

Before coming to the United States in 2001, Widjaja was a lecturer at the Economics Department, University of Indonesia and also a researcher at the Institute of Economic and Social Studies, University of Indonesia. He is an active member of the Indonesian Economist Association (ISEI) and had some articles published in prominent economics journals and newspapers in Indonesia. While studying as a graduate student at Georgia State University, he worked at the International Studies Program, Andrew Young School of Policy Studies. In the meantime, he also had some academic papers in the area of taxation presented at an academic seminar in Vancouver, Canada and the Indonesian embassy for the U.S., Washington D.C. He is married to Eugenia Mardanugraha.